Piedmont Nutrient Reduction Sourcebook

2011

Strategies for Reducing and Managing Nutrients to Waters of the North Carolina Piedmont

Piedmont Triad and Triangle J Council of Governments

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EXECUTIVE SUMMARY

The Piedmont Nutrient Reduction Sourcebook is a resource tool developed through partnership between the Piedmont Triad and Triangle J Councils of Governments (PTCOG & TJCOG, respectively). This book was created with the support of a federal 205(j) grant distributed by the NC Division of Water Quality (DWQ), and aims to provide a set of strategies for reducing and managing nutrients to waters of the North Carolina Piedmont.

In recent years, managing nutrients for water quality and maintaining designated uses for waterbodies has become a critical issue both throughout the country, and in North Carolina. In the US Environmental Protection Agency's (USEPA) 2000 National Water Quality Inventory, 39 percent of assessed river and stream miles, 46 percent of assessed lake acres, and 51 percent of assessed estuarine square miles did not meet water quality standards in the US. As such, the USEPA has been giving greater attention to non-point source pollution, and in North Carolina, knowledge and technology for addressing all forms of non-point source pollution are being applied due to a combination of greater environmental awareness and federal and state regulations. The following Sourcebook aims to summarize the tools and regulations that exist in North Carolina to address non-point source nutrient pollution.

The PTCOG and TJCOG service areas cover the Piedmont region, and many jurisdictions in these watersheds are governed by legislation designed to address and reduce nutrient inputs to the watershed from both existing and future developments. Regulations such as the Jordan Lake Rules and Falls Lake Rules recognize water quality conditions as a public priority, and aim to restore and protect water quality conditions so that they are safe, reliable resources for drinking and recreation far into the future. These regulations require local governments and water users to evaluate current policies and reassess how land use and development is considered and planned for in North Carolina. The result of these changes is already being seen in the Jordan Lake, Falls Lake and High Rock Lake watersheds, and may soon be extended to additional rivers and streams in the state's seventeen river basins.

The tools needed to successfully comply with these new nutrient management strategies are new to many local governments, who must balance environmental needs with the many other pressing issues in their communities. Furthermore, the soils, geology, and historical land use of the Appalachian piedmont presents many challenges unique to the region that have not been obstacles in other areas where effective nutrient reduction strategies have been implemented (i.e. the Great Lakes basin).

This *Sourcebook* and its corresponding website are designed to provide local governments with background on nutrient reduction strategies that have proven successful, and how to most cost-effectively apply them at the local scale. These strategies are not all required by the State or the USEPA (though some of them are), but they are programs, policies, practices, and partnerships all known to reduce nutrient inputs to Piedmont streams, rivers, and lakes.

TABLE OF CONTENTS

EXECUTIVE SUMMARY I
TABLE OF CONTENTS III
HOW TO USE THIS SOURCEBOOK 1
Using the Website 2
GLOSSARY 4
BACKGROUND 9
NUTRIENT MANAGEMENT IN NORTH CAROLINA 10
Regulatory Drivers for Managing Nutrients for Water Quality 10
Total Maximum Daily Loads (TMDLs) 10
Nutrient Management Strategies 11
National Pollutant Discharge Elimination System (NPDES) 11
Nutrient Management in Jordan Lake 13
Falls Lake Nutrient Management Strategy (Falls Lake Rules) 14
High Rock Lake Special Study 15
Buffer Rules in North Carolina 16
Nutrient Scientific Advisory Board 17
STRATEGIES FOR NUTRIENT REDUCTION 19
1) New Construction and Development 20
Policies 21
Practices 21
Programs 22
Partnerships 23
Contacts 23
Links 24
Publications 24
2) Enhanced Construction Site Inspections and Enforcement 25
Policies 25
Programs and Practices 26
Contacts 29
Links 29
Publications 29
3) Best Management Practices (BMP) Maintenance Program 30
Policies 30
Practices 31
Programs 32
Partnerships 32
Contacts 33
Links 33
Publications 33
4) Agricultural BMPs 35
Policies 35
Practices 36

Programs 36
Partnerships 37
Contacts 38
Links 38
Publications 39
5) Enhanced Septic Systems Maintenance & Operations 40
Policies 40
Programs 41
Contacts 42
Links 43
Publications 43
6) Low-Impact Development 44
Policies 44
Practices 45
Programs 45
Contacts 46
Links 46
Publications 46
7) Forestry Practice Guidelines 47
Policies 47
Practices 48
Programs 49
Partnerships 50
Contacts 50
Links 51
Publications 51
8) Illicit Discharge Detection and Elimination 52
Policies 52
Practices and Programs 53
Contact 54
Links 54
Publications 54
9) Riparian Buffers 55
Policies 56
Practices 57
Programs and Partnerships 57
Contacts 58
Links 58
Publications 58
10) Long-Term Water Quality Monitoring 59
Policies, Practices, Programs and Partnerships 60
Contacts 63
Links 63
11) Watershed Restoration Planning 64
Policies 65

Practices 66
Programs 67
Partnerships 68
Contacts 70
Links 71
Councils of Government 71
Publications 72
12) Targeted Land Acquisition and Conservation Easements 73
Policies and Practices 73
Programs and Partnerships 75
Contacts 76
Links 76
13) Outreach, Education, and Public Participation 77
Policies 78
Practices 79
Partnerships 79
Contacts 81
Links 81
Publications 82
REFERENCES 84
CONTACT US 94
APPENDIX A. LOCAL GOVERNMENT SURVEY 96
SUMMARY 96
NEW DEVELOPMENT 98
CONSTRUCTION SITE INSPECTIONS & ENFORCEMENT 99
BEST MANAGEMENT PRACTICES 100
AGRICULTURE 101
SEPTIC SYSTEM MAINTENANCE & INSPECTIONS 102
LOW IMPACT DEVELOPMENT 103
FORESTRY PRACTICES 104
ILLICIT DISCHARGE DETECTION & ELIMINATION 105
RIPARIAN BUFFERS 106
WATER QUALITY MONITORING 107
WATERSHED RESTORATION PLANNING 108
CONSERVATION PRACTICES 109
PUBLIC EDUCATION & OUTREACH 110
Appendix A References 111

TABLE OF TABLES

Table 1. Scientific Advisory Board for Nutrient-Impaired Waters 17
Table 2. LUESA Service Area 26
Table 3. CharMeck Post-Construction Storm Water Stakeholders Committee 28

TABLE OF FIGURES

Figure 1. Screen Capture of Website 3
Figure 2. Aerial View of the B. Everett Jordan Dam 13
Figure 3. Algal Bloom Depletes Water of Oxygen 13
Figure 4. Huntersville LID Site Plan Concept 20
Figure 5. Huntersville & Mountain Island Lake After A Rainfall 21
Figure 6. Residential Stormwater BMPs (King County, WA) 22
Figure 7. Photo: City of High Point 25
Figure 8. Charlotte-Mecklenburg Stormwater Wetland 25
Figure 9. LUESA Organizational structure (diagram created by PTCOG) 27
Figure 10. Photo: City of Jacksonville 30
Figure 11. Photo: City of Wilson 31
Figure 12. Photo: Division of Soil & Water Conservation 36
Figure 13. VAD Program 36
Figure 14. Photo by Wake county 41
Figure 15. Photo: LandDesign 44
Figure 16. Source: NCSU Dept of BAE 45
Figure 17. Photo: Division of Forest Resources 48
Figure 18. Jamestown: A Tree City USA Community 49
Figure 19. City of Hickory Landscape Ordinance 50
Figure 20. Photo: City of Wilmington, NC 52
Figure 21. Wash Water from a Commercial Car Wash (EPA) 52
Figure 22. Photo: Illict Discharge Along Abbotts Creek Tributary (PTCOG) 53
Figure 23. Riparian Buffer (USDA, National Resources Conservation Service) 55
Figure 24. Buffer Diagram depicting some Key Water Quality Functions of Buffers (PTCOG) 56
Figure 25. UNCWI Plan 57
Figure 26. USGS TAWSMP Monitoring Report 61
Figure 27. Erosion along Abbotts Creek in Davidson County 64
Figure 28. Swift Creek in Wake County (UNRBA) 65
Figure 29. Upper Neuse Phase IV Restoration Implementation 66
Figure 30. Rich Fork Creek Watershed Restoration Plan 67
Figure 31. Photo: NC Wildlife Resources Commission 69
Figure 32. Photo: Conservation Trust for North Carolina (link) 73

Figure 33. Orange County Transfer of Development Rights (Link) 74
Figure 34. Upper Neuse Clean Water Initiative Plan 75
Figure 35. Kids Having Fun with An Enviroscape 77
Figure 36. Eighth Grade Students participate in an Enviroscape presentation 79

HOW TO USE THIS SOURCEBOOK

The *Piedmont Nutrient Reduction Sourcebook* (hereafter referred to as the "Sourcebook")directly responds to the technical and programmatic needs of local governments interested in or required to reduce nutrient inputs to streams, rivers, and lakes. It is applicable throughout the Piedmont region of North Carolina, and includes background information on the water quality impacts of nitrogen and phosphorous, and outlines the purposes, goals, and local effects of nutrient reduction measures. The *Sourcebook* breaks down these nutrient reduction measures into 13 categories and details a combination of policies, programs, projects and partnerships designed to help communities meet nutrient reduction goals, with examples of successful nutrient reduction strategies employed by North Carolina Piedmont communities.

Using the *Sourcebook*, local governments can address their community's needs and develop a strategic action plan to reduce their nutrient loads to nearby waters. As such, this *Sourcebook* is a resource of immediate benefit to communities requiring guidance on efficient and effective methods to minimize nutrient inputs to receiving waters. Furthermore, the methods identified in the *Sourcebook* are based on successful models throughout the Appalachian Piedmont region of the Eastern United States.

The *Sourcebook* is available as both a document and as an online resource. The online version is designed to provide communities with brief summaries of each topic and contact information. The hard copy is designed to supplement the online version and includes links to research, case studies, survey information, and additional contact information.

This *Sourcebook* has two main sections. The first section includes a glossary defining terms, background on nutrient issues, and a description of federal and state regulations regarding nutrient pollution to fresh water and the need for this book. The second section is a set of 13 categories of nutrient-reducing strategies that can be implemented by local governments to help meet nutrient reduction targets and/or improve their environmental footprint. These categories include:

1. New Construction and Development;
2. Enhanced Construction Site Inspections and Enforcement Actions;
3. Best Management Practices (BMP) Maintenance Programs;
4. Agricultural BMPs;
5. Enhanced Septic Systems Maintenance and Operations Programs;
6. Low-Impact Design (LID) Education;
7. Forestry Practice Guidelines;
8. Illicit Discharge Detection and Elimination;
9. Riparian Buffers;
10. Long-term Water Quality Monitoring Programs;
11. Watershed Restoration Planning;

12. Targeted Land Acquisition and Conservation Easements; and
13. Outreach, Education, and Public Participation

Each category includes a description of programs, partnerships, practices, and policies (where applicable) that can be used to address these nutrient-related topics and contact information for communities that have successfully implemented such strategies, as well as regulatory contacts who can provide guidance on regulatory issues. Wherever possible, successful nutrient reduction strategies employed by North Carolina Piedmont communities were used to demonstrate the value of these approaches. In addition to contact information, the sections are also hyperlinked, allowing easy and quick access to resource information.

For the purposes of this *Sourcebook*, the following definitions for programs, partnerships, projects, and policies have been adapted from the Merriam-Webster dictionary to be complimentary to water resource terminology.

A **program** is defined as "a plan or system under which action may be taken toward a goal". An example of this includes the Huntersville stormwater program.

A **partnership** is defined as a "voluntary relationship involving close cooperation between individuals or localities having specified and joint interests, rights, and responsibilities." An example includes the Clean Water Education Partnership.

A **practice** is described as "a planned undertaking or action to achieve a certain goal". Examples include the Towns of Jamestown and Hickory's urban forestry guidelines and enforcement actions.

Finally, a **policy** is defined as "management or procedure based primarily on material interest, a method of action selected from among alternatives and in light of given conditions to guide and determine present and future decisions, or a high-level overall plan embracing the general goals and acceptable procedures of a governing body". An example includes the Upper Neuse River Basin Association's riparian buffer recommendation sheets.

USING THE WEBSITE

A website has been created to enhance the usability of this *Sourcebook*, and provides direct access to the links and publications referenced in this document. While this *Sourcebook* provides readers a strong understanding of nutrient reduction solutions, we highly recommend visiting the website as it more thoroughly breaks down the background of this emerging field and provides time sensitive material as it is made available. The website is available at www.piedmontnutrientsourcebook.org.

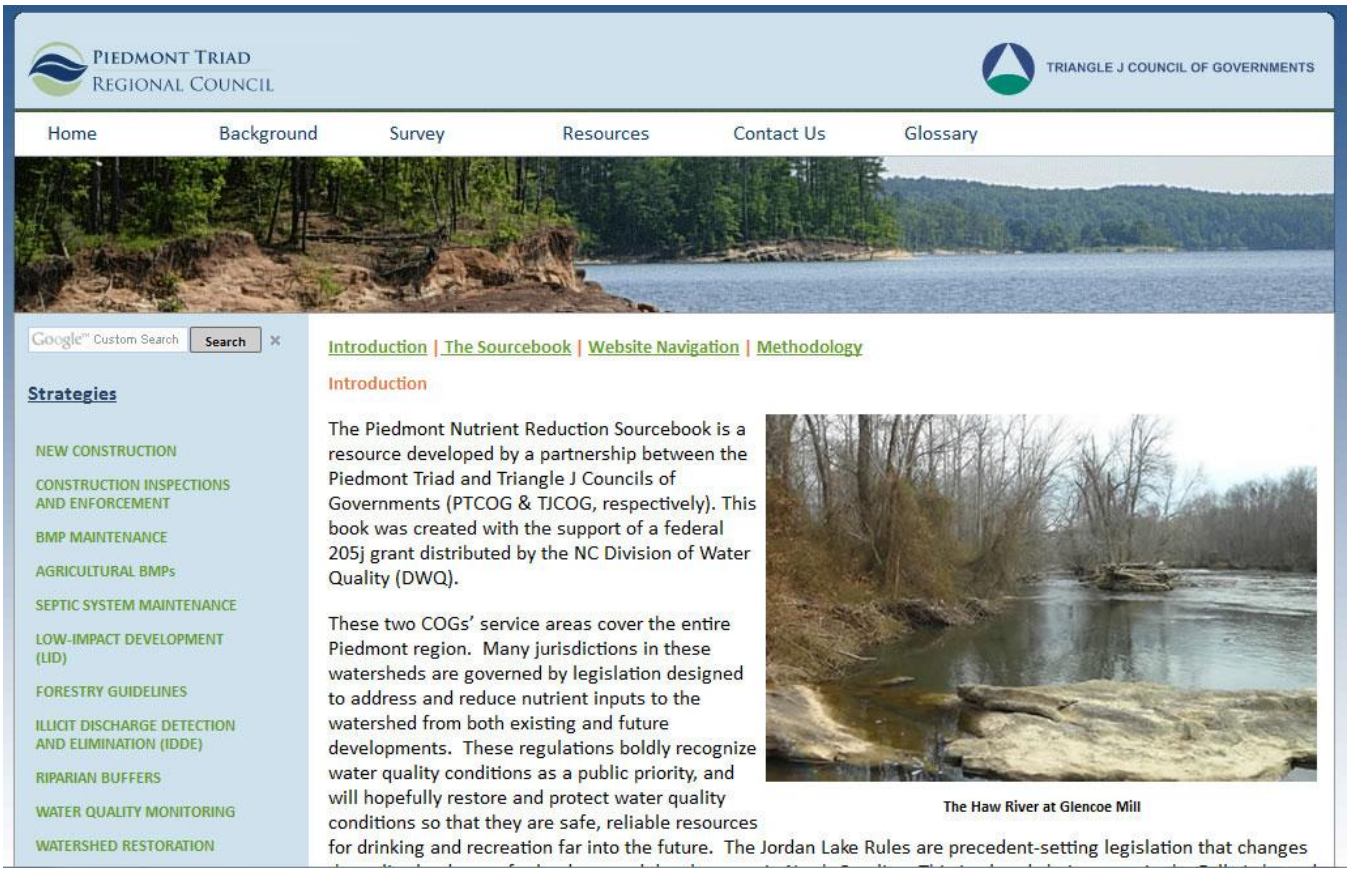

FIGURE 1. SCREEN CAPTURE OF WEBSITE

GLOSSARY

Adaptive Management: "A structured approach to resource management. Through this iterative process, managers and scientists can improve resource management over time by learning from management outcomes. Adaptive Management entails a multi-step process: 1. Considering various actions to meet management objectives; 2. Predicting the outcomes of these management actions based on what is currently known; 3. Implementing management actions; 4. Monitoring to observe the results of those actions; and 5. Using the results to update knowledge and adjust future management actions accordingly. By repeating this cycle and increasing to the body of knowledge about the system in question, managers are able to refine their prescriptions to more closely meet the original objectives". (USGS 2011a)

Arm: State-defined units that make up a larger watershed. Jordan Lake is divided into three arms, and the Jordan watershed is divided into three sub-watersheds that drain into these lake arms: the Haw River, Upper New Hope Creek, and Lower New Hope Creek Arms.

Best Management Practices (BMP): Structural, vegetative and managerial practices implemented to control nonpoint source pollution. (EPA 2011a)

Chlorophyll *a*: Chlorophyll is the green pigment that allows plants (including algae) to convert sunlight into organic compounds during photosynthesis. Of the several kinds of chlorophyll, chlorophyll ***a*** is the predominant type found in algae. (Chesapeake Bay Program 2011)

Confluence: Point at which two or more watercourses intersect or join. (Merriam-Webster 2011)

Culvert: A covered channel or a large diameter pipe that directs water flow below the ground level. (NCDENR 2011a)

Designated uses: "Water uses identified in state water quality standards for each water body or segment whether or not they are being attained. Uses can include water supply, aquatic life propagation, contact recreation, etc." (NCDENR 2011a)

E. Coli: Bacterium used as an indicator of the presence of waste from humans and other warm-blooded animals. (Merriam-Webster 2011)

Erosion: The wearing away of land surface by wind or water. Erosion occurs naturally from weather or runoff, but can be intensified by land-clearing practices related to farming, residential or industrial development, road building or timber cutting. (EPA 2011a)

Eutrophication: "The slow aging process during which a lake, estuary, or bay evolves into a bog or marsh and eventually disappears. During the later stages of eutrophication the water body is choked by abundant plant life due to higher levels of nutritive compounds such as nitrogen and phosphorus. Human activities can accelerate the process". Often characterized by algal blooms, eutrophic waters are hypoxic – sometimes anoxic – due to the oxygen-consuming decomposition process of algae. Eutrophication is indicative of the development of "dead zones." (EPA 2011a)

Fecal coliform bacteria: Colonies of bacteria found in the gastrointestinal tract of mammals, and therefore their feces, this water quality character indicates current nutrient inputs from biological sources, including sewage and septic infrastructures. High levels of fecal coliform bacteria are indicative of eutrophication. *E. coli* is the most common fecal coliform bacteria species. (EPA 2011a)

Geographical Information System (GIS): A system that analyzes and models data in a spatial context and displays digitally recreated map layers. (EPA 2011a)

Groundwater: The surface water supply in the saturated zone below the water table. (EPA 2011a)

Headwaters: The origin and upper reaches of a river or stream. (Merriam-Webster 2011)

Hydrologically distinct: Defined by drainage basins or watersheds rather than areas arbitrarily defined by political boundaries. (Expert Glossary 2011)

Hydrograph: A representation of a stormwater runoff that shows the volume and velocity of runoff entering receiving waters. Hydrographs clearly show the impacts of impermeable surfaces upon stormwater runoff. (Weather.Gov 2011)

Illicit Discharge: Any discharge into a storm drain system or waterway that is not composed entirely of stormwater. Illicit discharges often include pathogens, nutrients, surfactants, and various toxic pollutants. (EPA 2011a)

Impervious: A surface through which little or no water will move due to lack of pore space. Impervious areas include, but are not limited to, paved parking lots, roof tops, and compact clay soils. (EPA 2011a)

Infiltration: The penetration of water through the ground surface into the pores of subsurface soil or the penetration of water from the soil into sewers or other pipes through defective joints, connections or manhole walls. (NCDENR 2011a)

Low Impact Development (LID): A philosophy to community development that uses a holistic perspective to minimize a development's environmental footprint. This includes achieving a stormwater runoff volume and quality that is equivalent to that of pre-development conditions. (NCSU 2011a)

National Pollutant Discharge Elimination System: A federal program designed to minimize and reduce the impacts of urban stormwater runoff upon the nation's waters. See the Background section for more details. (EPA 2011a)

Nonpoint source pollution: Pollution caused when rain, snowmelt, or wind carry pollutants off the land and into the waterbodies. (EPA 2011a)

Notice of Violation (NOV): A legal document (including a formal letter) sent to parties violating laws or regulations. Planning and zoning staffs often use these to enforce watershed ordinances through cooperative tools. They are often used prior to issuing a fine for a violation, only if the property owners fails to comply following issuance of the NOV (NCDENR 2011a)

Permeable (aka Pervious) Pavement: Pavement that has a structure that allows stormwater to percolate through rather than running off the pavement surface. This percolation captures stormwater volumes and immediately disperses some of its kinetic energy and erosive force. It does offer some pollutant filtration purposes. This emerging BMP has, thus far, been found to perform best in sandy soils. (NCDENR 2011a)

Permit: An authorization, license, or equivalent control document issued by the EPA or an approved state agency to implement the requirements of an environmental regulation; e.g., a permit to operate a wastewater treatment plant or to operate a facility that may generate harmful emissions. (NCDENR 2011a)

pH: A measure of the acidity or alkalinity of a liquid or solid material. A pH value of 7 is regarded as neutral; pH values from 0 to 7 indicate acidity and from 7 to 14 indicate alkalinity. In North Carolina, the standard for pH states that pH shall be normal for waters of the area, which generally range between 6.0 and 9.0 except that swamp water may have pH as low as 4.3 if it is the result of natural conditions. (NCDENR 2011a)

Point source: The release of an effluent from a pipe, culvert, or discrete conveyance into a waterbody or a watercourse leading to a waterbody. (EPA 2011a)

Pollutant: Any substance of such character and in such quantities that when it reaches a body of water, soil, or air, it contributes to the degradation or impairment of its usefulness or renders it offensive. (EPA 2011a)

Resource management system: A combination of best management practices that, when installed, will at minimum protect the resource base by meeting acceptable soil losses; protect or improve water quality; and conserve plant, air, and animal resources. (NCSU 2011)

Riparian buffers: Vegetated areas next to water resources that protect water resources from nonpoint source pollution and provide bank stabilization and aquatic and wildlife habitat. (NCDENR 2011a)

Runoff: That portion of the precipitation or irrigation water that travels across the land and ends up in surface streams or water bodies. (EPA 2011a)

Sediment: Solid particulate matter, both mineral and organic, that has been or is being transported by water, air, gravity, or ice from its site of origin. (NC General Statute 1973)

Soil erosion: The wearing away of land surface by wind or water. Erosion occurs naturally from weather or runoff, but can be intensified by land-clearing practices related to farming, residential or industrial development, road building or timber cutting. (EPA 2011a)

Stakeholder: Any organization, governmental entity or individual that has a stake in or may be affected by a given approach to environmental regulation, pollution prevention or energy conservation. (EPA 2011a)

Stop work orders: A tool available to communities to enforce planning and zoning ordinances that halts construction on a site until the on-site practices are in compliance with local ordinances. (NC Division of Land Management 2011a)

Storm drain (storm sewer): A slotted opening leading to an underground pipe or an open ditch that carries surface runoff. (EPA 2011a)

Stormwater: Surface water runoff from paved surfaces following a precipitation event. It carries pollutants from paved surfaces, notably heavy metals, sediment, nutrients, and high temperatures to receiving streams in the watershed. (NCDENR 2011a)

Surface water: All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, wetlands impoundment, and seas). (EPA 2011a)

Suspended solids: Sediment particles in the water column and carried with the flow of water. (EPA 2011a)

Technical Review Committee/Commission (TRC): The permitting process required for any new developments that affords planners, public safety, and utility staff to review and comment upon the submitted engineering plans for a site. This process offers a natural opportunity to either formally or informally promote sustainable development practices. (NCDENR 2011a)

Topography: The physical features of a surface area including relative elevations and the positions of man-made features. (EPA 2011a)

Total Maximum Daily Load (TMDL): A calculation of the highest amount of a pollutant that a water body can receive and safely meet water quality standards set by the state, territory, or authorized tribe. See the Background section for more details. (EPA 2011a)

Total Suspended Solids (TSS): A measure of the suspended solids in wastewater, effluent or waterbodies. (EPA 2011a)

Tributary: A river or stream that flows into a larger river or stream at a confluence. (Merriam-Webster 2011)

Vegetative controls: Control measures or practices that usually involve the use of cropping systems, permanent grass, or other vegetative cover to reduce and control erosion. (EPA 2011a)

Water quality: The biological, chemical, and physical conditions of a waterbody, often measured by its ability to support life. (EPA 2011a)

Water supply watershed: The land area draining to a surface water that provides a population with drinking water. In North Carolina, these areas receive a special designated use classification that requires them to limit the density of development and the industrial uses of water in order to protect the water supply. (EPA 2011a)

Watershed: The geographic region within which water drains into a particular river, stream, or body of water. Watershed boundaries are defined by ridges separating watershed boundaries. (EPA 2011a)

BACKGROUND

In the US Environmental Protection Agency's (USEPA) 2000 National Water Quality Inventory, 39 percent of assessed river and stream miles, 46 percent of assessed lake acres, and 51 percent of assessed estuarine square miles did not meet water quality standards in the US. Most of the impairments were attributed to non-point source pollution, which includes both urban and suburban areas and construction sites. Non-point source pollution includes, but is not limited to: nutrients, bacteria, metals, and oxygen-depleting substances (USEPA 2000). Unaddressed illicit discharges add to this pollution burden.

The US Clean Water Act of 1972 required the USEPA to pursue and eliminate point sources of pollution, or obvious sources of pollution. At that time, many pollution problems could be attributed to polluted pipes draining directly to rivers. The USEPA had addressed most of these ***point*** sources of pollution by the 1990s; however, over time, it became clear that ***non-point*** source pollution was a persistent water quality problem (USEPA 2011b).

As such, since the late twentieth century, the USEPA has been giving greater attention to non-point source pollution, dedicating funding to research on the origins and solutions to pollutants that are not concentrated in pipes, but dispersed over large watersheds. These pollutants include stormwater, sediment, and nutrients. Eutrophication and fisheries losses in the Chesapeake Bay and the Mississippi River Delta areas have spurred greater investments in research and technologies to reduce nitrogen and phosphorous loadings to these very large freshwater systems (NAS 2004). Furthermore, the extraordinary costs to remedy water quality conditions in these two systems has provided a strong incentive to prevent water quality degradation in other important waterbodies (DWQ 2011a). In North Carolina, knowledge and technology for addressing all forms of non-point source pollution are being applied due to a combination of greater environmental awareness and federal and state regulations.

The USEPA and the NC Department of Environment and Natural Resources, Division of Water Quality (DWQ) have several lenses through which they can diagnose the sources of pollution to impaired waters (those streams, rivers, or lakes with degraded water quality conditions). One tool commonly used is the designation of "uses" for waterbodies. For example, there are human health and ecological health standards that waters must meet in order to meet their uses (e.g. drinking water supply); if they fail to do so, they are considered "impaired" for that use. Identifying the sources of these impairments is challenging, though the tools and solutions are improving every year. Along with Florida, DWQ has taken the lead in the Southeast US in developing many tools and supporting new technologies that aim to identify pollution sources and address stormwater and nutrient pollution. The following pages attempt to summarize the tools and regulations that exist in North Carolina to address non-point source nutrient pollution.

NUTRIENT MANAGEMENT IN NORTH CAROLINA

REGULATORY DRIVERS FOR MANAGING NUTRIENTS FOR WATER QUALITY

Under section 303(d) of the Clean Water Act (1972), States are required to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes. Water quality standards include the designated beneficial uses of a water (e.g., swimming, fishing, drinking water supply) and the water quality criteria (e.g. chlorophyll-*a*, bio-classification, pH, etc.) necessary to support those uses. All surface waters in the State are classified with at least one use classification. An "impaired water" is one that does not meet its water quality standards based upon its classified use.

Section 303(d) of the Clean Water Act requires that States establish priority rankings for impaired waters and develop TMDLs (Total Maximum Daily Loads) to achieve healthy water quality conditions. In North Carolina, the DWQ's Modeling and TMDL Unit (MTU) carries out the requirements of the Clean Water Act Section 303(d). The MTU develops the list of waters that do not meet their water quality standards, thereby designated as "impaired waters." Subsequently, the MTU prioritizes the impaired waters for development of TMDLs, and develops TMDLs. These loading limits are subsequently translated into management requirements to improve the quality of these waters, such that they meet their standards.

Total Maximum Daily Loads (TMDLs)

A TMDL is the maximum pollutant load that a water body can assimilate while still meeting its water quality standards. TMDLs are typically developed using water quality models appropriate to the characteristics of the water body (e.g. lake vs. river vs. estuary), the available data, the time and resources available to study the problem, and/or the severity and type of water quality impairment. The models can simulate the hydrologic, physical, biological and chemical processes of the aquatic system and its contributing watershed. Through mathematical calculations, these models provide estimates of pollutant loads and water body response under various scenarios (e.g. rainfall). The results of the model help to determine pollutant reductions needed to return the quality of the water to within compliance of State standards. The calculated total pollutant load at which the water body is estimated to be in compliance with its standards (aka "healthy") becomes the TMDL. The total load is then allocated among the various pollutant generating activities, which for nutrients often includes runoff from urban areas, agricultural lands, and other *nonpoint sources*, as well as permitted discharges like wastewater treatment plants and other *point sources*.

The allocated loads are typically incorporated into the federally required NPDES discharge permits for wastewater and stormwater point sources (see below). Where sources other than federally permitted discharges also contribute to the impairment, the federal Clean Water Act cannot mandate actions by those sources, but state-mandated regulations may. Otherwise, voluntary actions are necessary to achieve reductions from non-federally permitted discharges like nonpoint source runoff from

agricultural lands. The TMDL process can be difficult to conduct and often generates limits that provide little flexibility for the regulated community. An example of a TMDL would be the Jordan Lake TMDL (DWQ 2011b).

Nutrient Management Strategies

In 2005, NC Senate Bill 981 was passed requiring the NC Environmental Management Commission (EMC) to study water quality in water supply reservoirs and develop and implement nutrient management strategies (NMS) for impaired water supply reservoirs. Nutrient Sensitive Waters supplemental classifications also require the development of Nutrient Management Strategies. TMDLs and NMSs are similar and are both meant to determine a calculated total pollutant load a water body can accommodate and still be in compliance with its standards. TMDLs will always result in pollutant reduction targets, and a NMS will outline nutrient reduction targets for sources such as agricultural land and urban land, among others. A TMDL is a federally-mandated tool that affects only National Pollutant Discharge Elimination System (NPDES) permit holders while a NMS is state legislation that applies to all watershed stakeholders determined to be loading nutrients to a water body. An example of an NMS in North Carolina is the Falls Lake Nutrient Management Strategy (DWQ 2011c). DWQ's Nonpoint Source Planning Unit develops and leads implementation of these NMS's.

To learn more about TMDLs or NMSs, or to find out how nutrient regulations may apply to you, contact the following DWQ staff members: Kathy Stecker, Modeling and TMDL Unit Supervisor, at (919) 807-6422, Rich Gannon, Non Point Source Planning Unit Supervisor, at (919) 807-6440, Jason Robinson, Environmental Program Consultant, at (919) 807-6439, or John Huisman, Environmental Senior Specialist, at (919) 807-6436.

National Pollutant Discharge Elimination System (NPDES)

The NPDES program was created by the federal Clean Water Act of 1972. It prohibits the discharge of all pollutants to receiving waters without a federal permit. The NPDES program initially focused on wastewater discharges from municipal sewer systems and industries. However, in the 1990s, it began focusing on stormwater discharges that had been viewed up until then as nonpoint sources and that had been unaddressed and were degrading water quality conditions, and created a permitting program focusing on Municipal Separate Storm Sewer Systems (MS4s) that were from then on considered point sources by EPA (USEPA 2001).

Communities greater than 100,000 began receiving MS4 permits in 1990, in what is now termed Phase I of the NPDES program (USEPA 2001). The six North Carolina Phase I cities are Charlotte, Durham, Greensboro, Raleigh, Wilmington, and Winston-Salem, and they all received their NPDES permits in 1995. The requirements of this phase were to mainly map stormwater infrastructure and repair or enhance that system, as well as require communities to ensure that large (> 5 acres) construction sites are using soil and erosion control practices. Industrial sites were also permitted in order to address the

large volumes of stormwater runoff from these mostly paved sites. It has since been revised to address more persistent non-point source concerns (NCDENR 2011b).

Smaller communities and construction sites were brought into the NPDES program in 1999 in what was called NPDES Phase II, though these MS4 permits were not issued in North Carolina until 2005, and generally affected communities with populations greater than 10,000 people, with a population density >1,000 people per square mile, and/or within the greater metropolitan area of a Phase I city (NCDENR 2011c). The requirements of the Phase II MS4 permits are more extensive than those seen in the Phase I MS4 permits, and include the following six minimum measures:

- Public Education & Outreach
- Public Involvement
- Illicit Discharge Detection & Elimination
- Construction Site Control
- Post-Construction Site Control
- Good Housekeeping (a general term meaning that municipal staffs must be educated on how their practices affect water quality conditions)

The NPDES programs encourage communities to invest in BMPs that will address current stormwater runoff concerns. This can be done with structural BMPs and non-structural BMPs. Structural BMPs are explored more in Section 2 of this document, but, briefly, are engineering solutions to current stormwater concerns, such as retention ponds, constructed wetlands, and green roofs. Non-structural BMPs are programmatic approaches to addressing universal stormwater concerns in a community that include investments in more sustainable land use planning and policies, street sweeping, and public empowerment programs such as Adopt-a-Stream (DWQ 2007a).

Acknowledging that water quality problems persist despite the institution and enforcement of the NPDES Phase I & II MS4 permitting programs, the USEPA is researching the potential for national stormwater guidance and rules that will affect all municipalities, giving them performance standards for all significant new developments. Already being dubbed “Phase III,” a draft of these potential new requirements will be released in December 2011 for public comment (USEPA 2011c). Likely to be controversial and litigated, the final form and content of this next phase of stormwater and nutrient management is unknown.

The NPDES Phase I and II MS4 programs are administered by the individual States. Mike Randall (919-807-6743) is the DWQ Staff Engineer who administers the MS4 permits, and can answer questions regarding permit requirements and responsibilities. For more specific questions regarding engineering designs, new development site design and other permit requirements, please visit the DWQ Stormwater Permitting Unit website. Information on the North Carolina Stormwater Outreach and

Education Program is available at www.ncstormwater.org or by contacting Bridget Munger (919-807-6363).

Nutrient Management in Jordan Lake

Figure 2. Aerial View of the B. Everett Jordan Dam

The 1686-square mile B. Everett Jordan Reservoir ("Jordan Lake") watershed contains large portions of the populous Triangle and Triad regions, as well as significant amounts of pasture and other agricultural lands. It was created in 1983 by the damming of the Haw River a short distance upstream of its confluence with the Deep River. The reservoir was commissioned for the purposes of flood control, downstream water quality, fish and wildlife conservation, recreation and water supply.

Jordan Lake has been consistently rated as eutrophic or hyper-eutrophic since its impoundment in 1983. Nutrients make their way to the lake from sources such as wastewater discharges, rainfall runoff from farms, and stormwater runoff from cities and towns throughout the watershed. While not necessarily making the lake unfit for fishing, swimming or drinking uses, excess nutrients are impacting these uses. Proactively controlling nutrient inputs will help avoid algal blooms and dead zones and help prevent the spread of undesirable algae in the Lake.

The NC Environmental Management Commission (EMC) designated Jordan Lake a Nutrient Sensitive Water (NSW) the year of its impoundment, imposing phosphorus limits on wastewater dischargers to limit algal growth. In 2002, the EMC determined that the Upper New Hope arm of the watershed was "impaired" after it exceeded the state's chlorophyll-a limit. The rest of the lake exceeded this water quality standard in 2006. The Haw River arm also exceeded the pH standard in 2006.

FIGURE 3. ALGAL BLOOM DEPLETES WATER OF OXYGEN

According to DWQ (2011b), the Clean Water Responsibility Act of 1997 directed the EMC to address Jordan Lake's impairment and required the EMC to "establish improvement goals for nutrient-impaired waters and to develop and implement management plans that entail sharing of responsibility for reducing nutrient inputs to these waters between point sources and nonpoint sources in a fair, reasonable and proportionate manner." According to DWQ (2011b), a subsequent law (S.L. 2005-190) explicitly directed the EMC to adopt permanent rules to establish and implement nutrient management strategies to protect drinking water supply reservoirs.

As a result, the Jordan Lake Nutrient Management Strategy (Jordan Rules) were developed to "restore and maintain water quality, protect the lake's classified uses and maintain or enhance protections currently implemented by local governments in existing water supply watershed" (DWQ 2011b). The Jordan Rules include provisions and rules for Stormwater (both new and existing development), options for offsetting nutrient loads, riparian buffers, wastewater discharges, agriculture, and fertilizer management. A complete set of the rules can be found on DWQ's website at http://portal.ncdenr.org/web/jordanlake/7. For more information regarding the Jordan Rules, contact Rich Gannon or Jason Robinson at DWQ.

Falls Lake Nutrient Management Strategy (Falls Lake Rules)

The Falls Lake Nutrient Management Strategy, with the goal of attaining and maintaining nutrient related water quality standards in Falls Lake, was adopted by the EMC and became effective January 15, 2011. The strategy is comprised of two stages. The goal of the first stage (Stage I) is to achieve nutrient-related water quality standards in the lower portion of the lake, no later than January 15, 2021. The goal of Stage II is to achieve and maintain nutrient-related water quality standards throughout both the upper and lower lake, no later than 2041. The estimated reductions in nitrogen and phosphorous loading needed to achieve these standards is 40% and 77%, respectively, based on a 2006 baseline load.

The rules adopted cover five key areas including stormwater from new development, stormwater from existing development, wastewater discharges, agriculture, and stormwater from state and federal entities.

The new development rule requires that:

- Local governments implement standards for all proposed new development disturbing 1/2 acre or more for a single-family and duplex residential property and recreational facilities, and 12,000 square feet or more for commercial, industrial, institutional, multi-family residential, or local government property;
- Proposed new development shall not exceed 2.2 pounds/acre/year of nitrogen, and 0.33 pounds/acre/year of phosphorus;

- The developer shall have the option of offsetting a part of the nitrogen and phosphorus load offsite. If the proposed development disturbs one-half acre to one acre, or if it is in a downtown redevelopment area, then the project must achieve 30 percent or more of the load reduction onsite. If the disturbance is greater than one acre, then at least 50 percent of the load reduction must be achieved onsite; and
- Stormwater systems must be designed to control and treat at least the runoff generated from all surfaces of the project area by one inch of rainfall, and meet peak flow control requirements.

Control of stormwater from existing development is also included in the rules and may be the most difficult and costly to implement. The existing development rule requires that:

- By 2013, local governments must submit inventories characterizing the load reduction potential for wastewater collection systems; discharging sand filter systems; septic systems; riparian buffer, wetland, and utility corridor restoration opportunities; structural BMP retrofit opportunities;
- By 2014, local governments must submit plans for Stage I reduction;
- By 2020 (Stage I), local governments must offset loading from lands developed after the baseline year; and
- In Stage II, local governments must meet the load reduction goals of 40 and 77 percent total nitrogen and total phosphorous, respectively.

Wastewater dischargers received the following requirements:

- Mass limits to three large facilities in the upper watershed;
- Stage I allocations of 20 percent and 40 percent reduction in TN and TP respectively;
- Stage II allocations of 40 percent and 77 percent reduction in TN and TP respectively; and
- Concentration limits for two facilities in the lower watershed.

Other sources and activities are also regulated under the Falls Lake Rules including agriculture, land application of municipal bio-solids, NCDOT, and other State and federal entities.

High Rock Lake Special Study

High Rock Lake is a 15,180-acre recreational lake that was created by damming the Yadkin River in Davidson and Rowan Counties in 1927. It served as a power source for the Aluminum Company of America's (ALCOA's) aluminum smelting operations in the area (ALCOA 2011). High Rock Lake has been listed as impaired for high chlorophyll-*a*, pH, turbidity levels since 2008, though DWQ had commissioned special studies on the Lake for high algae levels in the early 2000s (NCDENR 2010; NCDENR 2011d).

High Rock Lake is currently under a special study to model the nitrogen and phosphorous loadings that are likely causing the high chlorophyll-*a* and pH levels. An environmental consulting firm (TetraTech) has been contracted by DWQ to develop these models, and is being audited by Limnotech, contracted by the Yadkin-Pee Dee River Basin Association, to ensure high quality control with the final model. These models are scheduled to be finished in the winter of 2011-12, and will specify what reductions in nitrogen and phosphorous levels would be necessary to restore healthy water quality conditions in High Rock Lake. Kathy Stecker (Kathy.Stecker@ncdenr.gov, 919-807-6422) and Pamela Behm (pamela.behm@ncdenr.gov, 919-807-6419) with the MTU are the project leads for this special study. All information about the High Rock Lake watershed special study and a potential TMDL for nitrogen and phosphorous can be found at http://portal.ncdenr.org/web/wq/ps/mtu/specialstudies.

Based upon precedent, it seems likely that these recommendations will be legislated through a Nutrient Management Strategy, similar to that seen in the Jordan Lake and Falls Lake watersheds. However, the legislation and any of the local government responsibilities detailed within will be determined by the Environmental Management Commission and the General Assembly.

Buffer Rules in North Carolina

The Division of Water Quality implements Riparian Buffer Protection Rules in the Neuse River Basin, Tar-Pamlico River Basin, Catawba River Basin, Randleman Lake Watershed, Jordan Lake Watershed and Goose Creek Watershed (NCDENR 2011e). In addition to the State's riparian buffer rules, there are also many *local* buffer protection programs (NCDENR 2011e).

Furthermore, there are other state programs that require buffers or setbacks from surface waters including Session Law 2006-246, Water Supply Watersheds, the Coastal Stormwater program, High Quality Waters, Outstanding Resource Waters and the Universal Stormwater Management program (NCDENR 2011). According to NCDENR (2011), there are also programs regulated under the Non-discharge (2T) rules with setbacks, including sewer extensions, irrigation systems and recycle systems, and the Division of Land Resources implements a buffer requirement on Trout waters.

In North Carolina, buffer rules have been established for the Neuse River Basin (15a NCAC 02b .0233), Jordan Lake Watershed (15A NCAC 02B .0267), Tar-Pamlico River Basin (15A NCAC 02B .0259), the Goose Creek Watershed (15A NCAC 02B .0607), the Catawba River Basin (15A NCAC 02B .0243), and Randleman Lake (15A NCAC 02B .0250). In general, the buffer applies to "intermittent streams, perennial streams, lakes, ponds, estuaries and modified natural streams that are depicted on the most recent published version of the soil survey map prepared by the Natural Resources Conservation Service OR the 1:24,000 scale quadrangle topographic map prepared by the U.S. Geologic Survey" (NCDENR 2011). A 50-foot buffer is a minimum requirement, although some watersheds have stronger requirements such as Goose Creek.

The State does allow some variances to Buffer Rules and most Buffer Rules include a Table of Uses which lists what uses are allowed and for what purpose (NCDENR 2011). Furthermore, some local governments are delegated to implement the State riparian buffer protection programs. A list of these local governments is available online at http://portal.ncdenr.org/web/wq/swp/ws/401/riparianbuffers/faqs#Where_are_riparian_buffer_protection_programs.

To learn more about Buffer Rules in your area, and to see if Buffer Rules apply within your municipality or jurisdiction, contact your local Division of Water Quality Regional Office or Amy Chapman in the DWQ Central Office at 919-807-6400. You can also visit DWQ's website on riparian buffer rules at http://portal.ncdenr.org/web/wq/swp/ws/401/riparianbuffers/rules.

Nutrient Scientific Advisory Board

The Jordan Lake Rules (in Session Law 2009-216) require the State to form a Nutrient Scientific Advisory Board (NSAB) for Nutrient-Impaired Waters. The role of the NSAB is to review and develop tools that can be used to address nutrient loading and accounting from *existing development* in any watershed where nutrients are of concern throughout the State. The Session Law requires that the NSAB be established with up to at least 10 representatives with various qualifications (e.g. licensed engineer, university representative, local government representative) by July 1, 2010. The current make-up of the NSAB has multiple local government representatives and is listed in Table 2 (DWQ 2011d).

TABLE 1. SCIENTIFIC ADVISORY BOARD FOR NUTRIENT-IMPAIRED WATERS

Board Member	Representative
City of Durham	John Cox, Stormwater Quality
City of Chapel Hill	Trish D'Arconte, Public Works
City of Burlington	Michael Layne, Public Works
City of Greensboro	David Phlegar, Stormwater Management
Town of Cary	Matt Flynn, Engineering
University of North Carolina	Lawrence Band, Department of Geography
North Carolina State University	Bill Hunt, Department of Bio. & Ag. Engineering
NC Department of Transportation	Matt Lauffer, Stormwater & Preliminary Studies
NC Conservation Network	Grady McCallie, Policy Director

According to DWQ (2011d), the primary role of the NSAB is to provide advice and recommendations to the DWQ and local governments on ways to effectively meet existing development requirements of nutrient strategies in general and more specifically, the Jordan Lake Stage 2 requirements. The primary responsibilities of the NSAB are to (Session Law 2009-216):

- Develop a method for estimating jurisdictional-scale loadings from existing development: baseline, post-baseline increases, and reduction goals (Section 3.(d)(2)b);
- Identify management strategies that can be used by local governments to reduce nutrient loading from existing development (Section 4.(b));
- Evaluate the feasibility, costs, and benefits of implementing the identified management strategies (Section 4.(b));
- Develop an accounting system for assignment of nutrient reduction credits for the identified management strategies (Section 4.(b)); and
- Identify the need for any improvements or refinements to modeling and other analytical tools used to evaluate water quality in nutrient-impaired waters and nutrient management strategies (Section 4.(b)).

The NSAB has been meeting monthly since September 10, 2010. Meeting agendas, summaries and materials for the Nutrient Scientific Advisory Board are available online and updated frequently, and should be referred to often as tools and ideas are continually being developed and refined. To learn more about the NSAB or for general inquiries about their role and progress, please contact Rich Gannon (DWQ) at 919-807-6440 or Jason Robinson (DWQ) at 919-807-6439.

STRATEGIES FOR NUTRIENT REDUCTION

The following section provides a summary of 13 categories of nutrient-reducing strategies that can be implemented by local governments to help meet nutrient reduction targets and/or improve their environmental footprint. These categories include:

1. New Construction and Development;
2. Enhanced Construction Site Inspections and Enforcement Actions;
3. Best Management Practices (BMP) Maintenance Programs;
4. Agricultural BMPs;
5. Enhanced Septic Systems Maintenance and Operations Programs;
6. Low-Impact Design (LID) Education;
7. Forestry Practice Guidelines;
8. Illicit Discharge Detection and Elimination;
9. Riparian Buffers;
10. Long-term Water Quality Monitoring Programs;
11. Watershed Restoration Planning;
12. Targeted Land Acquisition and Conservation Easements; and
13. Outreach, Education, and Public Participation

Each category includes a description of programs, partnerships, practices, and policies (where applicable) that can be used to address these nutrient-related topics and contact information for communities that have successfully implemented such strategies, as well as regulatory contacts who can provide guidance on regulatory matters. Wherever possible, successful nutrient reduction strategies employed by North Carolina piedmont communities were used to demonstrate the value of these approaches. In addition to contact information, the sections are also hyperlinked, allowing easy and quick access to resource information.

1) NEW CONSTRUCTION AND DEVELOPMENT

New developments have the potential to lead the way in illustrating the benefits of "getting it right" the first time with regard to stormwater runoff and nutrient pollution. By using development practices that are harmonious with the existing landscape, and using BMPs in ways that will address projected stormwater runoff from current and future developments, the need to fix these sites in the future to reduce their environmental footprints will likely be less necessary. This approach could be more cost-effective for local government, and less expensive than retrofitting sites developed using current trade standards. Many local governments have concerns that such regulations or standards will drive development to less restrictive jurisdictions, but if these requirements are universally applied, the regulatory playing field would remain level. Furthermore, as the Towns of Huntersville and Cary illustrate, more stringent development standards that are accompanied by bold economic planning can be a minor factor in a local housing market. If jobs are available, residences will be built, even with greater in-site design and stormwater management requirements.

The Jordan Lake Rules have a cumulative goal to reduce nitrogen and phosphorous in the Lake by 8% and 5%, respectively, from their 2001 levels. The Jordan Lake Rules prescribe different nutrient reduction targets for the three arms of the Lake watershed: both the Haw River and Upper New Hope Creek Arms must reduce nitrogen and phosphorous runoff levels by 8% and 5%, respectively, while the Lower New Hope reek Arm must maintain its nitrogen and phosphorous runoff at their 2001 levels. The Falls Lake Rules require 40% and 77% reductions in nitrogen and phosphorous, respectively, from their 2006 levels. Communities must not allow new development to add to their nutrient loads, and will require new programs and funding to achieve these ends.

FIGURE 4. HUNTERSVILLE LID SITE PLAN CONCEPT

The DWQ Nutrient Loading Accounting Tool (DWQ 2011e) was developed through partnership between DWQ and NCSU to address these very issues, enabling planners and developers to use a relatively simple spreadsheet tool to estimate the pollution runoff from a new development, and what BMPs, or combination of BMPs, can best mitigate these nutrient loads. It has been designed so that it can be used throughout North Carolina, regardless of soils, slopes, or geology, and is sensitive to the challenges of development in the Piedmont region. The capacity and ability of local governments to use this tool, as mandated in the Jordan and Falls Lake Rules, for creative and lucrative solutions to the nutrient management challenges development projects present will have to be seen as these state-mandated requirements are implemented in the coming years.

Policies

Huntersville lies just north of Charlotte on the watershed boundary between Mountain Island Lake and Lake Norman on the Catawba River. Mountain Island Lake is impaired for having low pH, or acidic conditions, and its primary tributary McDowell Creek has a history of degradation due to stormwater flows from Huntersville. To better address its stormwater mitigation needs, Huntersville began requiring LID for all new development in 2003. For more information on LID, please refer to the *Low-Impact Design Education* section.

The Town of Cary is part of the "Triangle" which is in the Neuse River Basin and Jordan Lake Watershed. It is one of the fastest growing areas of the United States with a growth rate of 43% in the last ten years (US Census Bureau 2011). As with any increase in urban growth, water quality is a concern. In 2001, when the Town of Cary adopted the Neuse River Rules, these rules were implemented in both the Neuse River and Jordan lake watershed in an effort to maintain water quality. Even with these water quality rules, in 2009, Cary received a TMDL for impervious cover (DWQ 2008), and must effectively reduce stormwater impact by 70% to restore the Swift and Williams Creeks. The Neuse River Rules (DWQ 2011f) required Cary to begin adapting its development practices and requirements, but the Town went further than mandated in an effort to improve water quality conditions by adopting 100 foot stream buffers and modifying the Town's Land Development Ordinance (LDO) to be more restrictive than State and Federal water quality rules.

FIGURE 5. HUNTERSVILLE & MOUNTAIN ISLAND LAKE AFTER A RAINFALL

Practices

LID in Huntersville, NC is required for all developments that are greater than 0.75 acre in size and that exceed 12% built-upon area. The LID requirements require 85% Total Suspended Solids (TSS) and 70% of Total Phosphorous (TP) removals by stormwater BMPs on-site, and there is not an option to mitigate these inputs offsite. Furthermore, no single BMP can accommodate a watershed larger than 5 acres. The stormwater volume that must be accommodated by a BMP is substantial: a 1-year rain event (~2.5 inches) in most zones, and a 2-year rain event (~3 inches) in rural and transition zones. 40-foot minimum riparian buffers are required on all parcels, and are credited as a stormwater mitigation practice (Town of Huntersville 2011).

All new development over one acre and/or that disturbs 12,000 square feet or more of land in Cary must meet the requirements of both the Neuse River Rules and the Jordan Lake Rules. These requirements are more stringent than those required by DWQ, but Cary sees these regulations as investments in their future and promoting sustainability. The responsibility for achieving these nutrient reduction targets is the property owner's, as is ensuring the site and any BMPs on it are in compliance which requires an annual inspection certified by a Professional Engineer.

NCDENR Contacts

All New Development and Construction must be approved by NC DWQ Stormwater Permitting. For all specific questions regarding these requirements, please contact listed staff.

Name	Phone	E-mail	Agency
Mike Randall	919-807-6374	mike.randall@ncdenr.gov	DWQ SW Permitting
Bill Diuguid	919-807-6369	Bill.diuguid@ncdenr.gov	DWQ SW Permitting

Programs

The Huntersville stormwater requirements are specified in a Concept Plan completed by the developer and submitted to the Town Planning and Zoning department prior to issuance of a building permit. An Excel-based Site Evaluation Tool (SET) must be used to calculate stormwater runoff from the impervious surfaces, and a hydrograph must display each proposed BMP's effectiveness (UNRBA 2006b). Huntersville requires a Preliminary Plan stating that a development complies with Town Zoning ordinances and Mecklenburg County watershed buffer guidelines; a Storm Water Management permit from Mecklenburg County verifying LID and BMP effectiveness; a summary table summarizing BMP performance and effectiveness; a Maintenance Covenant and Plan for all BMPs; and a bond of 120% construction costs $10,000 purchased by the developer (Town of Huntersville 2011).

FIGURE 6. RESIDENTIAL STORMWATER BMPS (KING COUNTY, WA)

Cary requires a pre-conference with the Contractor, at which the stormwater requirements are discussed. The Town issues warnings, notices of violation, and/or fines for violation of their stormwater, tree protection, and other ordinances. Should the project require a stormwater variance, the Town requires developers to meet with one or more of the following entities:

2.1.1 Ordinance Administration and Review Bodies

The following entities shall have roles in administering the provisions of this Ordinance:
(A) Town Council;
(B) Planning and Zoning Board;
(C) Zoning Board of Adjustment;
(D) Town Center Review Commission;
(E) Staff departments.

Partnerships

Huntersville works closely with the Mecklenburg County Land Use and Environmental Services Agency (LUESA) to ensure that all developments meet local development, stormwater, and soil and erosion control ordinances. LUESA provides the Town with stormwater services, including BMP inspection and maintenance, and ensures that all of their inspection services fulfill the Planning Department's needs. For more information on LUESA, please consult Section 2, "Enhanced Construction Site Inspections & Enforcement" (LUESA 2011)

The Town of Cary has fostered a collaborative relationship with the developers interested in projects within the town limits. This relationship is largely due to the interdepartmental communication amongst the planning, engineering, and parks and recreation departments to develop cohesive codes and ordinances in the first place, and then making sure that their respective executions and enforcements of these requirements are uniform and consistent (Town of Cary 2011).

Contacts

Huntersville **Whitney Hodges** *Senior Planner* (Subdivisions/Rezonings – Residential) P.O. Box 664 Huntersville, NC 28070 (704) 766-2212 whodges@huntersville.org	Town of Cary **Anna Readling** *Senior Planner* Planning Department P.O. Box 8005 Cary, NC 27512-8005 (919) 4699-4084 Anna.readling@townofcary.org
Town of Cary **Tom Horstman** *Stormwater Services Manager* Engineering Department P.O. Box 8005 Cary, NC 27513-8005 (919) 462-3932 Tom.horstman@townofcary.org	

Links

Cary, NC Growth	http://www.downtowncaryproperties.com/Downtown%20Growth/Cary%20Growth.html
Jordan/Falls Nutrient Loading Accounting Tool (DWQ)	http://portal.ncdenr.org/c/document_library/get_file?uuid=c54894f6-4d95-43d3-bdc5-c1c694253b24&groupId=38364
NC Impaired Waters List	http://portal.ncdenr.org/c/document_library/get_file?uuid=8ff0bb29-62c2-4b33-810c-2eee5afa75e9&groupId=38364
Neuse River Rules	http://portal.ncdenr.org/web/wq/ps/nps/neuse
Site Evaluation Tool (SET) (Upper Neuse River Basin Association)	http://www.unrba.org/unrba/set
Town of Huntersville Zoning Ordinance	http://www.huntersville.org/ZONING_TOC.htm
Mecklenburg County Land Use and Environmental Services Agency (LUESA)	http://charmeck.org/24ecklenburg/county/WaterandLandResources/Pages/default.aspx
Swift Creek Biological Integrity TMDL	http://portal.ncdenr.org/c/document_library/get_file?uuid=4ca9deaf-d9af-4e68-8f25-b8e4c7be3f0b&groupId=38364
Town of Cary Departments Directory	http://www.townofcary.org/Departments.htm
US Census Bureau, NC 2010 Population	http://www.census.gov/popest/cities/files/SUB-EST2009_37.csv

Publications

Jordan New Development Model Program (DWQ)	http://www.piedmontnutrientsourcebook.org/Assetts/New Construction/jordan_model_program_EMC_approved_3.10.11.pdf
Jordan New Development Model Program (appendices) (DWQ)	http://www.piedmontnutrientsourcebook.org/Assetts/New Construction/jordan_model_program_EMC_approved_3.10.11_appendices.pdf
Mecklenburg County Watershed Buffer Guidelines	http://www.piedmontnutrientsourcebook.org/Assetts/New Construction/watershedappendixa.pdf
Swift Creek TMDL	http://www.piedmontnutrientsourcebook.org/Assetts/New Construction/SwiftCreekTMDL.pdf

2) ENHANCED CONSTRUCTION SITE INSPECTIONS AND ENFORCEMENT

Development disturbs soils that can wash away into lakes, rivers, and streams. These soils are bound by nutrients and add to these waters' pollutant loads. The US EPA has developed practices and procedures to ensure that soils are managed to not be sources of pollution, known as Soil and Erosion Control for construction practices and stormwater management for post-construction practices. Construction and Post-Construction Stormwater Management are two of the six minimum measures in the National Pollutant Discharge Elimination System program (USEPA 2011d).

FIGURE 7. PHOTO: CITY OF HIGH POINT

Construction management requires soil and erosion control measures that retain 85% of the total suspended solids on-site. Post-construction stormwater management is often achieved through BMPs, and requires a minimum of 85% total suspended solids (TSS) retention and management of the first inch of stormwater runoff. Policies that address nutrient retention on-site and complement existing sediment-focused regulations, and that require modeling and inspections to ensure these requirements are met, will ultimately reduce sediment flow into receiving waters (see the New Construction and Best Management Practices sections for details).

FIGURE 8. CHARLOTTE-MECKLENBURG STORMWATER WETLAND

Since Construction and Post-Construction Maintenance and Inspections have been required under the NPDES Phase II program, many watershed communities (should) have fully-realized programs and accompanying ordinances in place. The City of Charlotte and Mecklenburg County Stormwater Services Department is the State leader in addressing these needs with adequate funding, staffing, and regulatory frameworks, and has made a name for itself in showing foresight to anticipate its needs for the near future. These services are closely aligned and often overlap with the other maintenance and inspections services, including BMP Inspections.

Policies

The City of Charlotte, Mecklenburg County, and the six smaller municipalities in the County merged their stormwater departments in 2007, in response to the designation of the County and its smaller

municipalities as NPDES Phase II communities that year (see Table 2 for list of all CharMeck communities) (LEUSA 2011).

The City of Charlotte is one of North Carolina's six Phase I communities, and has had a stormwater program since 2001. However, these communities have had a shared water quality program since 1969, due to the high need to address septic and sewage concerns in the City. This regional and multi-jurisdictional approach has allowed this stormwater utility to be well-prepared for most federal and state regulations regarding water quality, and serve its nearly one million residents effectively.

LUESA Service Area Communities
City of Charlotte
Town of Cornelius
Town of Davidson
Town of Huntersville
Town of Matthews
Mecklenburg County
Town of Mint Hill
Town of Pineville

TABLE 2. LUESA SERVICE AREA

This coordination of programming falls under the Mecklenburg County Land Use & Environmental Services Agency (LUESA), which saves costs and simplifies provided services by collecting essential programs under one umbrella, and sharing the costs among the eight communities that have pooled their resources to support LUESA for the past forty years (see Figure 8).

The ordinance detailing the services and requirements of the construction and post-construction program took a total of two years of a stakeholder process to draft and adopt. This committee was a diverse collection of public, private, and non-profit interests with vested interests in the ordinance (see Table 3). The ordinance had to minimally meet NPDES Phase II requirements and address all water quality impairments within the County. An additional year was then needed to get all eight of the affected communities to adopt the general ordinance. Authority to administer the ordinance was given to LUESA.

NCDENR Contacts

All Construction Sites have requirements for inspections and maintenance of soil and erosion controls and other BMPs. The Division of Land Resources and DWQ Wetlands & Stormwater programs oversee these programs and services. For all specific questions regarding these requirements, please contact listed staff.

Name	Phone	E-mail	Agency
Gray Hauser	919-733-4574	Gray.hauser@ncdenr.gov	DLR Land Quality
Boyd DeVane	919-807-6373	Boyd.devane@ncdenr.gov	DWQ Wetlands & SW

Programs and Practices

LUESA's Land Development program inspects all soil and erosion control practices. It requires developers and/or landowners pay for the inspections services through their soil and erosion control

fee. Frequently, these construction relationships evolve into post-construction inspection relationships.

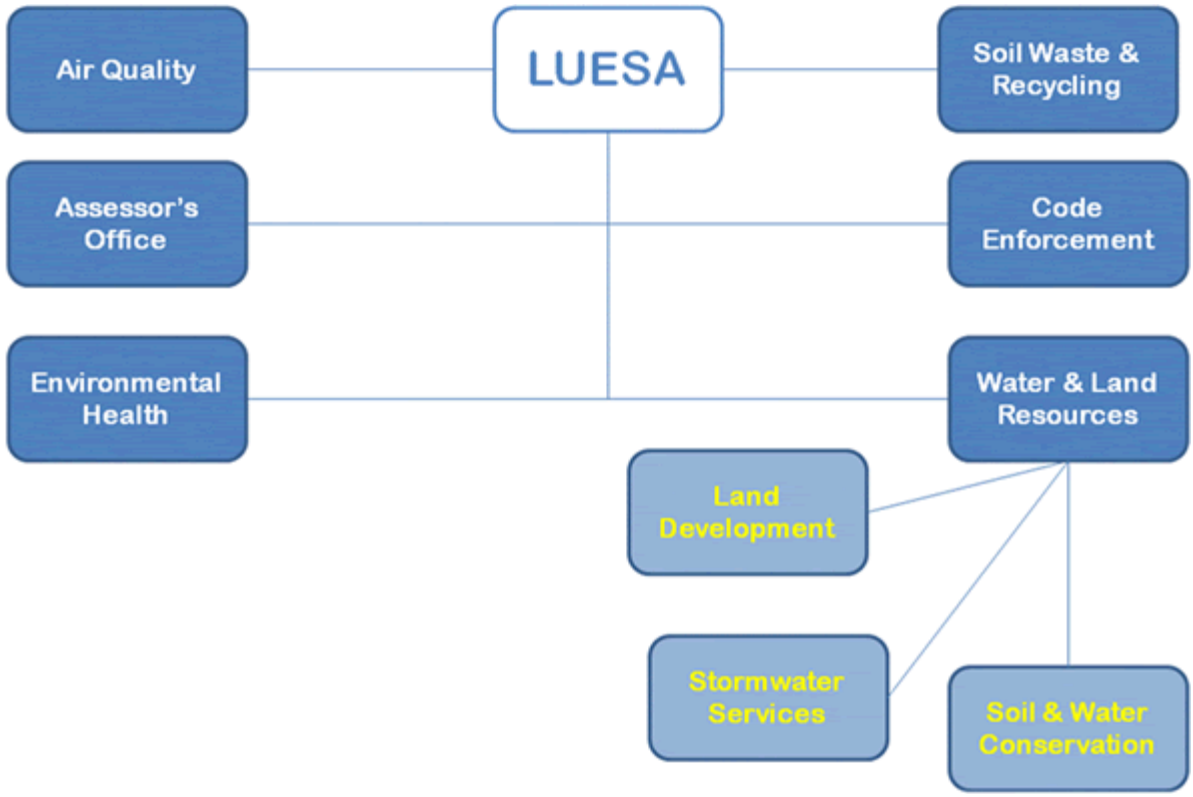

FIGURE 9. LUESA ORGANIZATIONAL STRUCTURE (DIAGRAM CREATED BY PTCOG)

LUESA's Water Quality Program employs a staff of thirty employees for their post-construction inspections program. They have four staff that inspect the 500 BMPs within their jurisdiction. These inspections differ depending upon the watershed: if a development is in a Nutrient Sensitive Watershed, endangered species habitat, or on an impaired water, then nutrients and sediment have to be retained on-site at a greater level. This has unexpected impacts, such as making stormwater management in downtown Charlotte the least restrictive of all of the communities.
Compliance with the post-construction ordinance is high, with only 5% of all sites being fined. LUESA works hard to fix the problems with non-punitive measures. If a problem is identified, the inspector will speak directly with the party about how to address it, as well as sending a notice of violation. If there is no response, a warning letter is sent explaining fines the party could face if they fail to fix the problem.

TABLE 3. CHARMECK POST-CONSTRUCTION STORM WATER STAKEHOLDERS COMMITTEE

Organization	Representative
Charlotte Chamber of Commerce	Dale Stewart
Charlotte-Mecklenburg Planning Commission	Mark Loflin
Charlotte Property Owner(s)	Tim Mead & Amy Ringwood
Charlotte-Mecklenburg Utilities Advisory Committee	John McLaughlin & Steven Wilson
Home Builders Association	Rich Keagy & Dan Latta
Marine Commissions	Dan Duval & Edna Chirico
Mecklenburg County and Towns	Rusty Rozzelle
NAIOP/Commercial Board of Realtors	Tim Bahr & Curtis Trenkelbach
Northern Towns	Phil Visser
Southern Towns	Chuck DiLullo
Real Estate and Building Industry Coalition (REBIC)	Mark Cramer & Chris Micci
Sierra Club	Rick Roti
Storm Water Advisory Commission	Roy Alexander & Paul DuPont
Subdivision Steering Committee	Marc Houle
UNC-Charlotte	Jim Bowen

All of the BMPs must be bonded and maintained by the landowner for two years, at which point, LUESA will take over the maintenance responsibilities for these practices. For private properties, LUESA requires inspectors be certified through a Site Inspector Training that the program hosts.

The other departments aid LUESA in their effort through the Cityworks program. This SQL-based software integrates with GIS, and allows police officers, water and sewer maintenance crews, etc., to contact LUESA by a GPS unit if they identify a stormwater problem. The software is highly adaptable, giving them flexibility to report directly from the field, and includes a .pdf report with photos. Though its annual license is $100,000, it is fully integrated into all public services. Charlotte-Mecklenburg was the only community interviewed because they are widely recognized as the state leader in construction inspections and enforcement.

Contacts

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Links

Mecklenburg County Land Use & Environmental Services Agency (LUESA)	http://charmeck.org/mecklenburg/county/LUESA/environment/Pages/default.aspx
Cityworks	http://www.cityworks.com/

Publications

City of Charlotte Post-Construction Administrative Manual	http://www.piedmontnutrientsourcebook.org/Assetts/inspections/PCCOCityAdminMan0709.pdf
Mecklenburg County and Six Towns Post-Construction Administrative Manual	http://www.piedmontnutrientsourcebook.org/Assetts/inspections/PCO Administrative Manual - WEB.doc
National Pollutant Discharge Elimination System	http://cfpub.epa.gov/npdes/
DWQ Stormwater BMP Manual	http://portal.ncdenr.org/web/wq/ws/su/bmp-manual
Protecting the Nation's Waters Through Effective NPDES Permits	http://nepis.epa.gov/Adobe/PDF/P1005JQ8.PDF

3) BEST MANAGEMENT PRACTICES (BMP) MAINTENANCE PROGRAM

Stormwater Best Management Practices (BMPs) are the best technology available to control stormwater runoff pollution and volume from development. BMPs vary in size, purpose, and expense, but all serve a common purpose of intercepting stormwater runoff, dissipating its energy, filtering its pollutants, and absorbing some of the volume that otherwise would enter catchment waters (lakes, streams, etc.) in large, concentrated volumes. Structural BMPs are increasingly being required by states throughout the country (See New Construction for details).
There are two types of BMPs: structural and non-structural. Structural are the more commonly known engineered solutions to stormwater management and pollutant removal, such as constructed wetlands and rain gardens. Non-structural BMPs can include street sweeping or disconnecting roof drains.

The City of Wilson has been successful in requiring and maintaining structural BMPs to mitigate stormwater runoff and capture large sediment volumes (City of Wilson 2011). The Town of Archdale utilizes innovative technology to prevent stormwater runoff from becoming an issue, adopting the philosophy that an ounce of prevention is worth a pound of restoration (City of Archdale 2011).

Policies

The USEPA's National Pollutant Discharge and Elimination System (NPDES) Phase II program "is intended to further reduce adverse impacts to water quality and aquatic habitat by instituting the use of controls on the unregulated sources of stormwater discharges that have the greatest likelihood of causing continued environmental degradation" (EPA 2011e). The DWQ does not require a statewide stormwater performance standard, but generally requires BMPs to capture and treat the runoff from the first inch of precipitation and removing 85% of total suspended solids (DWQ 2009a). The Jordan Lake Rules and Falls Lake Rules limit the amount of nitrogen and phosphorus allowable in stormwater runoff at new and existing developments (see New Construction section for more details).

FIGURE 10. PHOTO: CITY OF JACKSONVILLE

Wilson is a city of about 50,000 located on the fringe of the Piedmont and the Coastal Plan, east of Raleigh. It has had to consider BMPs for nutrient reduction purposes due to the Neuse River Nutrient Management Strategy, which requires a 30% nitrogen reduction from 1995 levels (DWQ 2011f).

The Town of Archdale has a population of about 10,000, and is located southeast of High Point. It drains directly to Lake Randleman, and must abide by the land use regulations NC has mandated within that watershed (DWQ 1999). The Town began a stormwater program in response to these regulations,

with a planning perspective that recognizes the value of engineering and site designs that anticipate future environmental needs as opposed to reacting to them.

Practices

A BMP can be something as simple as a grass swale on the roadside or, more recognizably, green roofs and constructed wetlands (DWQ 2009b). NC communities frequently meet their TSS removal needs with retention ponds. Retention ponds can accumulate algae, Canada geese, and trash, and require regular maintenance. They are also a significant liability and maintenance concern for communities. Furthermore, in the Piedmont, retention ponds remove only 25% of nitrogen from stormwater runoff (as opposed to a bioretention cell or constructed wetlands removal rate of 35-45%) (NCSU 2003).

FIGURE 11. PHOTO: CITY OF WILSON

The BMPs that will best fill nutrient reduction needs are bioretention cells, stormwater wetlands, and sand filters (NCSU 2003). They also are three of the more expensive BMPs to design and construct, particularly in the Piedmont where soils are predominantly clay. The DWQ has a guidance table that details the cost, function, and best use of all known BMPs that are available for developers and governments to employ in addressing stormwater onsite (DWQ 2009b). The DWQ also has a Nutrient Loading Accounting Tool that allows planners and developers the opportunity to use a relatively simple spreadsheet to model a new development site and stage multiple scenarios of BMP(s) to treat stormwater runoff from the site, and what approach and/or combination of BMPs will most cost-effectively treat nutrient runoff (DWQ 2011b). Local governments must ensure that these BMPs are installed and work properly, or risk state and possible federal fines.

Policy decisions by local governments can enhance nutrient reduction efforts. Many states and local governments have banned manufactured phosphorous in fertilizer. This is prominent in the Great Lakes region (City of Ann Arbor 2006) as well as along the Chesapeake Bay watershed, including New York and Maryland.

NCDENR Contacts

All BMPs have state requirements for inspections and maintenance. The DWQ Wetlands & Stormwater and Stormwater Permitting programs oversee these local needs. For all specific questions regarding these requirements, please contact listed staff.

Name	Phone	E-mail	Agency
Robert Patterson	919-807-6375	robert.patterson@ncdenr.gov	DWQ SW Permitting
Annette Lucas	919-807-6381	annette.lucas@ncdenr.gov	DWQ Wetlands & SW

Programs

The City of Wilson must comply with the Neuse Nutrient Strategy to reduce nitrogen levels 30% from 1995 levels, and is aggressively addressing the sediment loadings to a smaller impaired watershed (DWQ 2011f). The City of Wilson requires BMP owners to inspect the BMP monthly and after every 0.5-inch rainfall. Almost no BMP owners do this. However, Wilson Stormwater staff conducts annual inspections and notes failed BMPs, sending the appropriate entity or person a Notice of Violation. If a second inspection reveals that the BMP is still not functioning properly, the City repairs the BMP and charges the owner 125% the total cost of repair. This approach often saves the project owner money and assures Wilson that the BMP is functioning properly (City of Wilson 2011).

The Archdale Stormwater program takes advantage of the relatively small area of the Town and evaluates each development proposal individually, considering a parcel's proposed structure's footprint on the property (City of Archdale 2011). Importing AutoCAD to GIS allows a site-specific model of stormwater runoff from the site, and allows staff to best site BMPs for the proposed development. This system may be time-intensive for larger communities, but it can forecast stormwater impacts and prevent retrofitting. The whole program is an extremely cost-effective non-structural BMP. To support this program, each property is charged $150 annually for a single BMP inspection. Archdale strongly encourages developers to use dry ponds and constructed wetlands to receive stormwater runoff, as they can both reduce nutrients by 15 – 40% onsite and work well with the local high water table.

Partnerships

NCSU's Department of Biological and Agricultural Engineering (NCSU B&E) is widely known as one of the best stormwater BMP design programs in the country. Wilson has sought NCSU B&E staff on multiple occasions with grant-funded BMPs that serve both their nutrient reduction needs and NCSU research needs (NCSU 2004).

Contacts

Wilson	Archdale
Daryl Norris	**David (DJ) Señeres**
Stormwater Environmental Specialist	*Stormwater Program Manager*
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Wilson, NC 27894-0010	Archdale, NC 27263
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dnorris@wilsonnc.org	dseneres@archdale-nc.gov

Links

City of Ann Arbor Phosphorus Fertilizer Ordinance	http://www.a2gov.org/government/publicservices/systems_planning/Environment/Pages/PhosphorusFertilizer.aspx
City of Wilson	http://wilsonnc.org/departments/publicservices/stormwatermanagement/
Clean Water Education Partnership	http://www.nccwep.org/
Jordan/Falls Lake Stormwater Nutrient Loading Accounting Tool (Version 1.0) User's Manual	http://portal.ncdenr.org/c/document_library/get_file?uuid=c54894f6-4d95-43d3-bdc5-c1c694253b24&groupId=38364
Little Alamance Restoration Alliance	http://stormwatersmart.org/lara.html
Maryland Department of the Environment Stormwater Management	http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/Pages/programs/waterprograms/sedimentandstormwater/swm2007.aspx
Measurable Goals Guidance for Phase II Small MS4s	http://cfpub.epa.gov/npdes/stormwater/measurablegoals/index.cfm
National Menu of Stormwater Best Management Practices	http://cfpub.epa.gov/npdes/stormwater/menuofbmps/
Neuse River Nutrient Management Strategy	http://h2o.enr.state.nc.us/nps/neuse.htm
NCSU's Department of Biological and Agricultural Engineering	http://www.bae.ncsu.edu/
Stormwater SMART	http://www.stormwatersmart.org
Wilmington Stormwater Outreach and Education	http://www.wilmingtonnc.gov/public_services/stormwater/education_outreach.aspx

Publications

An Evaluation of Cost and Benefits of Structural Best Management Practices in NC	http://www.neuse.ncsu.edu/Stormwater_BMP_Factsheet.pdf
North Carolina's Stormwater Requirements	http://portal.ncdenr.org/c/document_library/get_file?uuid=e8f09947-5f5a-414c-a453-90de49cfc984&groupId=38364
Randleman Lake Water Supply Watershed: Stormwater	http://ncrules.state.nc.us/ncac/title 15a - environment and natural resources/chapter 02 - environmental management/subchapter b/15a ncac

Requirements	02b .0251.pdf
Toisnot Creek Stormwater BMP Project	http://www.bae.ncsu.edu/stormwater/PublicationFiles/ToisnotCreek2004.pdf
Selecting the Right BMP	http://portal.ncdenr.org/c/document_library/get_file?uuid=8c575385-7ce4-47a2-86f5-2a4cf415160e&groupId=38364
Stormwater Pond & Wetland Maintenance Guidebook (CWP)	http://www.stormwatercenter.net/Manual_Builder/Maintenance_Manual/pondwetlandguidebookdraft.pdf

4) AGRICULTURAL BMPS

Because of the potential for runoff to become contaminated with sediment, pesticides, and fertilizers, agricultural operations can pose a number of risks to water quality and public health (UNRBA 2007). Excess nutrients in water can cause or contribute to eutrophication, anoxia, and microbe outbreaks. However, working lands are important parts of local histories and economies, and when properly managed, agricultural activities can be compatible with healthy water quality and aquatic habitat (UNRBA 2007).

The Upper Neuse Watershed Management Plan (Tetra Tech 2003) recommends that counties "assist in cost-sharing with farmers to implement practices to reduce the amount of sediment, nutrients, herbicides, and pesticides running off the land into nearby streams and lakes. These efforts may include conservation cropping [tillage], contour farming, crop rotations, chemical application plans, grazing systems, development of ponds, tree planting, and vegetated stream buffer maintenance. At a minimum, work with Soil and Water Conservation Districts, Natural Resources Conservation Service, Cooperative Extension Service, and the state to help target areas for needed for agricultural BMPs."

According to the UNRBA (2007), in general, local governments cannot apply restrictions other than lot size to agriculturally zoned districts. Within agricultural zones, USDA-Natural Resources Conservation Service (NRCS) standards and guidance may affect where facilities are located (UNRBA 2007). Voluntary Agricultural District (VAD) designations can help ensure that rezoning decisions factor in existing agricultural operations and local Soil and Water Conservation Districts (SWCD) and NRCS personnel can assist farmers with siting agricultural activities on their lands (UNRBA 2007).

Nontraditional agricultural operations such as horse boarding, nurseries, dirt stockpiling, and community-supported agriculture are on the rise and these industries are likely to continue growing as development encroaches on rural lands, rural lands become more fragmented, and/or some agricultural lands are converted to low-density residential developments with agricultural components (UNRBA 2007). These nontraditional agricultural operations present management challenges because even though they are considered agriculture (and therefore cannot be regulated by the local government other than to protect public health), they may have significant amounts of impervious cover, fertilizer or pesticide use, or land disturbance and because local SWCDs may not have been made aware of them (UNRBA 2007).

Policies

The UNRBA (2007) provides a comprehensive recommendation sheet outlining steps communities can take to address nutrient pollution from agricultural land including information on cooperative agricultural organizations, soil and water conservation districts and programs, cost-assistance programs for farmers, and cost-shared agricultural BMPs. Furthermore, the UNRBA's *Recommendation Sheet #15: Agricultural Best Management Practices Education and Outreach* document (2007) provides

a comprehensive list of basic implementation steps and a section on "above and beyond basic implementation." For more information, please visit UNRBA's website at http://www.unrba.org/docs/unwmp/RecSheet15.doc.

Practices

Eight county Soil and Water Conservation Districts (SWCDs) have received 319 funding to implement additional BMPs in the Jordan Lake watershed. These local SWCD offices will assist farmers in installing a "Stream Protection System," featuring a number of BMPs including exclusion fencing, well and waterline installation, grassed waterways, field borders or buffers, and other practices.

FIGURE 12. PHOTO: DIVISION OF SOIL & WATER CONSERVATION

Programs

Although BMPs are expensive, many programs have been put in place to help farmers protect water quality. Generally, farmers are willing to take measures to protect water quality if funding is available. The following programs are designed to help meet these needs.

- **North Carolina Agriculture Cost Share Program (NCACSP)**
  A voluntary program designed to encourage the use of Best Management Practices (BMP's) for agricultural production. This program provides cost share and incentive payments for conservation measures that improve water quality.
- **Community Conservation Assistance Program (CCAP)**
  A voluntary, incentive-based program designed to improve water quality through the installation of various BMP's on urban, suburban and rural lands, not directly involved in agricultural production. This program provides cost share and technical assistance for the installation of stormwater best management practices on non-agricultural land.
- **Environmental Quality Incentives Program (EQIP)**
  To provide a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as reauthorized in the Farm Security and Rural Investment Act of 2008 (Farm Bill).
- **Voluntary Agricultural District Program**
  Landowners voluntarily commit to enhance the identity of their agricultural community by encouraging the voluntary preservation and protection of farmland from non-farm development. The preservation of these rural and lands permit greater infiltration of precipitation that would be stormwater runoff if developed.

FIGURE 13. VAD PROGRAM

NC Department of Agriculture & Consumer Services Contacts

The NC Division of Soil & Water Conservation oversees all agricultural regulations and related conservation programs in the state. They have agents in every county who work with landowners on implementing programs and projects, but they also have state staff available to answer questions you have regarding water quality rules for the farming community, and programs that can address these water quality demands.

Name	Phone	E-mail	Agency
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Tom Hill	919-715-6107	Thomas.hill@ncagr.gov	DSWC Non Point Source
Kelly Ibrahim	919-715-9631	Kelly.ibrahim@ncagr.gov	DSWC Non Point Source

Partnerships

The North Carolina Soil and Water Conservation Partnership has one of the nation's top soil and water conservation programs for private lands. The Partnership is comprised of the state division, local conservation districts and the United States Department of Agriculture—Natural Resource Conservation Service as well as private and nonprofit entities.

The Farm Preservation Working Group in Guilford County is an excellent example of how local governments can use partnerships to protect and improve agricultural lands. The Group is represented by various groups in the county including Guilford County Soil and Water Conservation District, the League of Women Voters, the Guilford County Open Space Committee, Guilford County Cooperative Extension, the Piedmont Conservation Council, the Resource Conservation and Development Council (RC&D), and the Piedmont Land Conservancy. The group meets informally to address agricultural needs in the County and manage the Farm Preservation Plan for Guilford County.

The NC Cooperative Extension is another instrumental resource for NC farmers. With offices in every county of the state, the Cooperative Extension offers the expertise and resources developed by NCSU's agricultural and conservation programs – especially the Department of Biological and Agricultural Engineering – providing unbiased, research-based information to local governments and interested property owners. It provides comprehensive non-point source programs and training opportunities with these resources, often working closely with Soil and Water Conservation staff to best meet the needs of farmers.

Contacts

Rockingham County Soil and Water Conservation District **Kevin Moore** *Department Head* *District Watershed Conservationist* Rockingham AG Center 525 Hwy. 65 Reidsville, NC 27302 (336) 342-0460 Ext. 3 kmoore@co.rockingham.nc.us	Guilford County Soil and Water Conservation District **Millie Langley** *District Watershed Conservationist* 3309 Burlington Road, Room 108 Greensboro, NC 27405-7405 (336) 375-5401 ext. 3 millie.langley@nc.ncacdnet.net
Alamance County Soil and Water Conservation District **Phil Ross** *Department Head* Agriculture/Environmental Center 209 N Graham Hopedale Rd. Burlington, NC 27217 (336) 228-1753 ext.3 phil.ross@alamance-nc.com	

Links

American Farmland Trust	http://www.farmland.org/
Conservation Trust for North Carolina	http://www.ctnc.org/site/PageServer
Guilford County Cooperative Extension	http://guilford.ces.ncsu.edu/
Guilford County Soil and Water Conservation District	http://www.co.guilford.nc.us/planning_cms/soil.html
Guilford County Open Space Committee	http://gcms0004.co.guilford.nc.us/government/ced/openspace.html
Land Trust Alliance	http://www.landtrustalliance.org/
League of Women Voters	http://www.lwvpt.org/
Neuse Rules (Ag)	http://www.piedmontnutrientsourcebook.org/Assetts/Agricultural BMPs/VADBro.pdf
Voluntary Agricultural District Program	http://www.piedmontnutrientsourcebook.org/Assetts/Agricultural BMPs/VADBro.pdf
NC Division of Soil and Water	http://www.ncagr.gov/sw/about-the-division.html
NC Department of Agriculture & Consumer Services	http://www.ncagr.gov/
NC Farm Transition Network	http://www.ncaswcd.org/
NRCS Conservation Programs	http://www.ncaswcd.org/
Piedmont Conservation Council	http://www.nc.nrcs.usda.gov/contact/directory/rcd.html
Piedmont Land Conservancy	http://www.piedmontland.org/

Resource Conservation and Development Council	http://www.nc.nrcs.usda.gov/contact/directory/rcd.html
Tar-Pamlico Rules (Ag)	http://www.ncagr.gov/sw/tarpamriverbasin.html
US Department of Agriculture	http://www.usda.gov/wps/portal/usda/usdahome
Web Soil Survey	http://websoilsurvey.nrcs.usda.gov/app/

Publications

Community Conservation Assistance Program	http://www.piedmontnutrientsourcebook.org/Assetts/Agricultural BMPs/ccapbrochure2008.pdf
Guilford County Voluntary Agricultural District Ordinance	http://www.cals.ncsu.edu/wq/lpn/PDFOrdinances/GuilfordCounty.pdf
North Carolina Agriculture Cost Share Program	http://www.piedmontnutrientsourcebook.org/Assetts/Agricultural BMPs/NCACSP.pdf
NC Division of Soil and Water Conservation CCAP Stormwater Best Management Practice Design Manual	http://www.piedmontnutrientsourcebook.org/Assetts/Agricultural BMPs/2007_July_DSWC_Manual.pdf
Voluntary Ag District Brochure	http://www.piedmontnutrientsourcebook.org/Assetts/Agricultural BMPs/VADBro.pdf

5) ENHANCED SEPTIC SYSTEMS MAINTENANCE & OPERATIONS

Municipal wastewater treatment ("sewer") plants are highly regulated and legally obligated to prevent leaks and spills (NCDENR 2011i). Decentralized wastewater systems ("package plants"), if effectively managed, will perform well and protect the environment. However, septic tank owners are not as closely scrutinized (USEPA 2011h). The risk of pathogens (e.g., bacteria, viruses, cryptosporidiosis), nutrients (e.g., nitrates, phosphorous), pharmaceuticals, and chemical/household cleaning products are increased with lack of diligent upkeep of onsite systems. They are estimated to be contributing are estimated to be contributing 14% and 9% of the nitrogen and phosphorous loadings, respectively, into Falls Lake. A septic or on-site wastewater monitoring program is separate from an Illicit Discharge Detection & Elimination (IDDE) program, but related in its potential to become an illicit discharge entering storm drains, reservoirs, or seeping into groundwater wells.

North Carolina does not treat all septic systems equally. Generally speaking, the smaller, private tanks often used at residences are not regularly inspected; larger tanks used at commercial sites are inspected regularly by DWQ staff. Residential and small commercial septic systems (Types I – III) require no reporting, nor inspections. All larger sizes (Types IV – VI), are required by NC administrative code to report their systems' performance(s) at least annually. Please see 15A NCAC 18A .1961 for greater details.

The Town of Nags Head has aggressively addressed septic tank maintenance and inspections (Town of Nags Head 2011). Due to sandy soils and its location on the Outer Banks, all septic systems pose a potential threat to the Town's aquifer – its only water supply. Person County has a long-standing septic system maintenance and operations program that is part of its Board of Health. Chatham County has instituted their septic systems maintenance and inspections program as a private responsibility to maintain performance standards on their systems.

Policies

In 1997, U.S. EPA's Response to Congress on Use of Decentralized Wastewater Treatment Systems stated that septic systems are the second most common threat to ground water resources (EPA 1997). 15A NCAC (North Carolina Administrative Code) 18A.1961 (B) Maintenance of Sewage Systems addresses the need to ensure septic systems are properly maintained and inspected (DPH 2011). The end result of the monitoring program is to improve the performance of decentralized systems by promoting continuous management.

The Town of Nags Head has a population of 3,016 and its land area is 6 square miles. Nags Head is located in coastal North Carolina, making its groundwater susceptible to exfiltration from septic systems. Over 85% of home and business owners in the Town use onsite systems. As a result, its citizens have been proactive with improving septic system performance. The Septic Health Initiative was created in the fall of 2000, but efforts and concerns began in the mid-90s. The Septic Health

Initiative committee created four major programs, one which included septic monitoring program (Town of Nags Head 2011).

Person County is a county of 404 square miles and about 36,000 people in North Carolina's northern Piedmont region. The septic monitoring program was initiated in 1999, at the county's request and with help from the state's environmental health program improvement team. The size of Person County is similar to other counties and areas within the Jordan Lake watershed community (Person County 2011).

Chatham County has an area of 709 square miles, and a population of about 49,329. Chatham County's program started in 2005 and who has a monitoring specialist who oversees the program in the Environmental Health Division, including 6 specialists in the on-site wastewater program (Chatham County Environmental Health Division 2011).

NCDENR Contacts

The Division of Waste Management address all installation and inspection requirements for septic systems of all sizes, and can answer questions from communities on their local regulatory requirements for these needs.

Name	Phone	E-mail	Agency
Ethan Brown	919-707-8249	ethan.brown@ncdenr.gov	DWM Solid Waste
Carmen Johnson	919-707-8271	carmen.johnson@ncdenr.gov	DWM Solid waste

Programs

FIGURE 14. PHOTO BY WAKE COUNTY

Nags Head's water quality coordinator is in charge of the Septic Health Initiative program. The town provides educational and informational materials to prospective onsite septic system owners. Since the cost of replacing or repairing systems can be high, Nags Head has developed a low interest loan program. The town also offers an inspection rebate for qualifying systems, and a $30 credit voucher if the septic tank needs to be pumped (Town of Nags Head 2011).

Chatham County does not institute a storm water fee yet, but has incorporated a clause in their new stormwater ordinance. The county's onsite wastewater monitoring programs webpage provides informational links for septic homeowners for maintenance, tips, and owner's guide to efficient and

effective use. The site also provides links for certified subsurface operators, and a link to the North Carolina Administrative Code, reaffirming the department's authority to inspect systems (Chatham County Environmental Health Division 2011).

The Person County Board of Health has a program specialist to support their septic system monitoring program. Part of their funding comes from permit fees and the rest is covered by general funds. Their program's responsibilities have been given to a staff of 6 County Health Department members. The monitoring program has been added along with the other current responsibilities. They have been successful in monitoring and inspecting all systems (Type III (b), IV, V, and VI) listed under 15A NCAC 18A .1961 (Person County 2011).

Contacts

Nags Head **Todd Krafft** *Water Coordinator of Septic Health* Planning & Development Department Town of Nags Head 5401 S. Croatan Hwy Nags Head, NC 27959 (252) 449-6047 krafft@townofnagshead.net	Chatham County **Jonathan Godfrey** *Environmental Health Program Specialist* **Kim Warren** *On-Site Program Coordinator* Environmental Health Division Chatham County Public Health Department 80 East Street P.O. Box 130 Pittsboro, NC 27312 (919) 545-8319 mailto:jonathan.godfrey@chathamnc.org mailto:kim.warren@chathamnc.org
Person County **Harold Kelly** *Environmental Health Supervisor* Division of Environmental Health Person County 325 S. Morgan St. Roxboro, NC 27573 (336) 597-1790 hkelly@personcounty.net	

Links

Chatham County Environmental Health Division	http://www.chathamnc.org/Index.aspx?page=611
NPDES Wastewater Permitting & Compliance Program	http://portal.ncdenr.org/web/wq/swp/ps/npdes
Decentralized Wastewater Treatment	http://www.epa.gov/gmpo/dwtreatment.html
Person County Environmental Health Septic Section	http://health.personcounty.net/PCHD/Department+Services/Environmental+Health/Septic+Systems/default.aspx
Town of Nags Head Septic Health Initiative	http://nagshead.govoffice.com/index.asp?Type=NONE&SEC=%7BF43EBE1E-2B2D-4F36-8182-0544F0BEEAD1%7D

Publications

15A NCAC 18A .1961 Maintenance of Sewage Systems	http://www.piedmontnutrientsourcebook.org/Assetts/Septic/Maintenanceofsewagesystems.pdf
EPAs Response to Congress on Use of Decentralized Wastewater Treatment Systems	http://www.piedmontnutrientsourcebook.org/Assetts/Septic/EPAs Response to Congress.pdf

6) LOW-IMPACT DEVELOPMENT

Limiting the impacts of new development to the environment is a leading area of research known as Low Impact Development (LID). LID considers and minimizes the immediate and long-term impacts to the environment. For the purposes of stormwater management, the goal is to simulate pre-development runoff volumes and water quality. Maryland requires LID for all new development to lessen the stormwater burden to Chesapeake Bay, and in a landscape and with soils similar to those found in the NC Piedmont. EPA is pushing the adoption of this practice, beginning with an ambitious redevelopment project in Philadelphia. NCSU recently completed *Low Impact Development: A Guidebook for North Carolina* that details the options and benefits of LID projects that have been implemented in the state.

LID communities recognize the need for all citizens to have access to necessities. Such considerations emphasize pedestrian access and/or a transit system that offer alternatives to automobiles. This approach reduces local carbon emissions that new development can be held responsible for, an issue for watershed communities in non-attainment with USEPA air quality standards for ozone and particulate matter.

LID is seen by many as the future of residential development, and may be part of a comprehensive, long-term solution to the nutrient reduction needs within the Jordan Lake and Falls Lake watersheds. The LID approach is well-documented as an appealing consumer option to young professionals and families willing to pay more for a lifestyle that is conveniently accessible to grocery stores, the post office, entertainment, etc. These properties are both immediately valuable and, due to their environmentally-sustainable design, a long-term cost savings (ECONorthwest 2007). Stormwater runoff should not be a retrofit concern due to the BMPs required in LID.

Policies

The Town of Huntersville is a community of about 40,000 people just outside Charlotte. It began mandating LID for all new development in 2003, both in anticipation of the NPDES Phase II requirements and in reaction to its residence within Critical Watersheds and impaired watersheds. Though met with resistance from the development community, the requirements were incorporated within the unified development ordinance (Town of Huntersville 2011).

FIGURE 15. PHOTO: LANDDESIGN

The City of Hickory had to embrace LID in order to expand their Jacob's Fork WWTP on the Catawba River (NC DWQ 2010). DWQ and the US Fish & Wildlife Service were concerned about the degraded river basin, and required the City to offset potential impacts from the WWTP. Hickory opted to require LID within the watershed, and adopted Huntersville's LID ordinance for this particular area of the City in 2004. The LID ordinance was written to complement the tree preservation ordinance the City adopted in 2000 (Town of Huntersville 2011) .

NCDENR Contacts

The emerging field of LID is currently being addressed by the DWQ's Stormwater Permitting staff. They have access to many of the national, academic, and professional resources to assist communities in applying LID principles to their communities and environmental footprints.

Name	Phone	E-mail	Agency
Mike Randall	919-807-6374	mike.randall@ncdenr.gov	DWQ SW Permitting
Bridget Munger	919-807-6363	Bridget.munger@ncdenr.gov	DWQ SW Permitting

Practices

FIGURE 16. SOURCE: NCSU DEPT OF BAE

As of 2006, compliance with the Huntersville LID requirement was high for new development. However, redevelopment of pre-LID lots have had noticeably higher sales rates than the new lots with the LID features. Huntersville has a comprehensive LID Manual that builds upon the BMP Manual provided by DWQ. The Town's manual walks through the requirements and provides them with staff to contact (Town of Huntersville 2008). Due to the low number of development projects for the past few years, no homeowner or HOA has held BMP ownership. Due to aggressive outreach efforts by the Town and the County, developer compliance with the inspection and maintenance requirements has been high, as has BMP performance (Town of Huntersville 2008).

There has been one small residential development in Hickory that has incorporated LID requirements in its construction, but, due to the economic recession, it has not been completed. Most new development occurs in areas not required to use LID and that still have greenspace.

Programs

The most dramatic results from implementing the Huntersville LID ordinance are seen on commercial properties. The Lowe's Grocery Store and the Shops at Berkdale shopping mall were both built using LID standards. They both have aided the Town in creating public buy-in for the new LID standards.

The area of Hickory affected by the LID ordinance is older and largely built upon. The impact of the ordinance has little immediate impact upon development, but will be engaged with any infill projects. The synthesis of tree preservation and LID demands upon Hickory's aesthetic and environmental needs has been best seen in several sustainable commercial developments.

Contacts

Hickory	Huntersville
Cal Overby *Principal Planner* 76 N. Center St. Hickory, NC 28601 (828) 323-7487 coverby@ci.hickory.nc.us	**Whitney Hodges** *Senior Planner* 105 Gilead Road Huntersville, NC 28070 (704) 875-7000 whodges@huntersville.org

Links

EPAs Low Impact Develop (LID) webpage	http://www.epa.gov/owow/NPS/lid
EPAs Low Impact Development Video	http://www.epa.gov/owow_keep/NPS/lid/video.html
Huntersville Zoning Ordinance	http://www.huntersville.org/ZONING_TOC.htm
Maryland Stormwater Design Manual	http://www.mde.state.md.us/programs/Water/StormwaterManagementProgram/MarylandStormwaterDesignManual/Pages/programs/waterprograms/sedimentandstormwater/stormwater_design/index.aspx

Publications

The Economics of Low-Impact Development: A Literature Review	Assetts/lid/Economics-Literature-Review.pdf
Huntersville Water Quality Design Manual	Assetts/lid/NC_LID_Guidebook.pdf
Jacob's Fork WWTP on the Catawba River	http://h2o.enr.state.nc.us/basinwide/documents/Chapter2-03050102.pdf
Low Impact Development: an economic fact sheet	http://www.ces.ncsu.edu/depts/agecon/WECO/nemo/documents/WECO_LID_econ_factsheet.pdf
Low Impact Development: A Guidebook for North Carolina	http://www.ces.ncsu.edu/depts/agecon/WECO/lid/documents/NC_LID_Guidebook.pdf

7) FORESTRY PRACTICE GUIDELINES

Forest land cover is optimal for the natural filtering process that can produce clean and abundant water (NCFS 2010). Sustainable forestry practices can allow a forest owner to maintain their property as forestland cover while realizing income, in lieu of converting their forest to a development, agricultural production, or other non-forested land use.

The concept of "ecosystem services" that are produced or derived from forests is gaining traction in some parts of the U.S. These eco-services may relate to water, air, wildlife, or general quality-of-life. Ongoing research and financial analyses seem to indicate that higher proportions of forest cover within a watershed can result in lower water filtration costs as well as a more sustained supply of water, with less water supply fluctuations during droughts.

Practices related to the establishment, management, and ongoing protection of trees and tree cover within towns or cities are collectively referred to as Urban Forestry. Some larger cities employ full-time urban forestry specialists, while smaller municipalities manage their urban trees with existing departments or staff personnel.

Historically, urban forestry has focused on aesthetics. However, strategically planting and managing urban trees within an urban watershed may prove beneficial as a stormwater management tool. In addition, trees absorb carbon dioxide and produce oxygen, which could aid a community's ability to achieve compliance with air quality standards. In addition, the shade provided by trees can reduce the need for air conditioning and associated electric demand burden.

Policies

Forestry practices such as timber harvesting, prescribed burning, and tree planting are widespread across rural areas of North Carolina. To protect water quality during such forestry activities, there are state-implemented regulations called the *Forest Practices Guidelines Related to Water Quality*, abbreviated as FPG's, and cited in state code 15A NCAC 01I .0100-.0209. Local Forest Rangers or Foresters with the North Carolina Forest Service (NCFS), an agency of the NC Department of Agriculture & Consumer Services, inspect forestry sites across the state to monitor compliance with the FPG's and other pertinent regulations (NCFS 2007). According to reports from the NCFS, the average statewide FPG compliance rate has exceeded 90% over the last 5 years (NCFS 2011a).

Among the other forestry regulations in the piedmont region are the mandatory state-implemented riparian buffer rules (NCFS 2011b) along certain streams in the Jordan Lake watershed, and a similar set of rules within the Randleman Lake watershed, as well as buffer rules for the Catawba River. It should be noted that Session Law 2005-447 (SB681) prohibits counties and local governments or

municipalities from restricting forestry activities under most situations. This law is intended to apply consistent regulatory oversight on forestry practices.

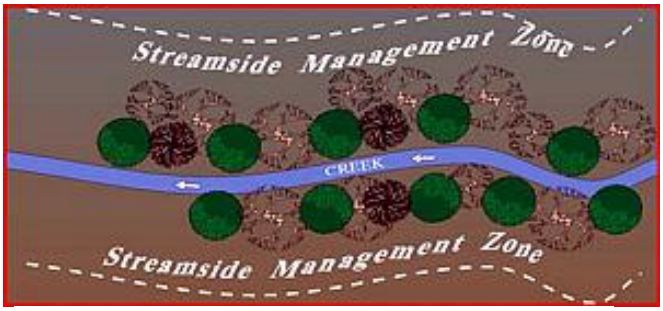

FIGURE 17. PHOTO: DIVISION OF FOREST RESOURCES

In 2007, the Town of Jamestown decided to create an ordinance to protect older trees, as well as requiring developed sites to be replanted (Town of Jamestown 2011). Jamestown must meet the nutrient management rules in the Lake Randleman watershed, which includes 100-foot riparian buffers and no development on slopes exceeding 15% (DWQ 1999). The Town uses its tree ordinances to shade streets and parking lots, hide dumpsters, and prevent clear-cutting and total grading.

The City of Hickory has had a comprehensive tree preservation and restoration ordinance since 2000 (City of Hickory 2008). It arose in response to the reclassification of part of the City to a Watershed IV water supply watershed in the Catawba River basin. Rather than having a patchwork of ordinances throughout the City, they consolidated all land development requirements into a unified development ordinance.

Practices

Implementing forestry Best Management Practices (BMPs) is strongly promoted as a viable and effective method to comply with the FPG rules, as well as promote soil conservation practices. The NCFS has a comprehensive set of forestry BMPs, and associated training/education toolkit.

A 2011 report from the NCFS indicates that on average, forestry BMPs were implemented 85% of the time on the 212 active logging sites that were evaluated statewide over a 2 year period. An example of a forestry BMP is to use portable bridgemats when a logger must cross over a stream to harvest timber. The photo shows a set of bridgemats in-use.

Jamestown has two enforcement tools it can rely upon regarding tree management: it requires a letter of credit that it can draw upon for penalties (which has never been used); and the NC general stormwater permit that allows them to revoke development privileges for up to three years if land is cleared without permission or in violation of ordinances (this has been used). Compliance with the

urban tree ordinance has been high and well-received (NC General Assembly 2005). This high level of compliance, however, may be skewed due to the recession that has slowed development.

Hickory prefers to showcase uncommon native trees and prevents developers from using environmentally-inefficient trees such as crape myrtles. There has been a high rate of compliance with the commercial sector, including a project at a Walgreens that saw a savings in landscaping costs through the preservation of 8 oaks with 60-inch diameters. Cooperation from the residential development sector has been less successful, with the City levying fines against developers that have razed entire plats despite the site design plan. Similarly, developers will "log" a site for low-grade timber, placing themselves beyond the authority of local governments, and then request a new residential zoning. Create a conditional penalty for any rezoning of clear-cut agricultural sites to residential or commercial may be a tool that could be used to minimize these land uses, though it is currently prohibited by State Law 2005-447 (NC General Assembly 2005).

NC Department of Agriculture & Consumer Services Contacts

The NC Forest Service oversees all forestry operations for the state. They have agents for every county in the state, but state staff in the central offices are available to answer questions about regulations and requirements for forestry operations.

Name	Phone	E-mail	Agency
Tom Gerow	919-857-4824	tom.a.gerow@ncagr.gov	DFR Non-Point Source

Programs

The North Carolina Forest Service (NCFS) operates an Urban & Community Forestry Program which administers funding for urban forestry projects through a competitive grant process, allocating funds that are provided by the USDA-Forest Service. The NCFS program also provides technical assistance to local governments and administers the state's TreeCity USA program, which recognizes municipalities for their efforts towards urban tree protection and management.

FIGURE 18. JAMESTOWN: A TREE CITY USA COMMUNITY

Jamestown retains regulatory power to ensure that ordinance compliance. Tree preservation and revegetation issues are usually worked out through the Technical Review Committee. This includes details such as species selection, which can have long-term impacts relevant to stormwater retention capacity and property values. Developers are permitted to use the tree preservation requirements to fulfill their riparian buffer needs and the 10% open space requirement. Jamestown also has a Tree Preservation and Landscape Ordinance (Town of Jamestown 2011).

The Hickory ordinance has led to a high success in increasing urban tree cover, particularly on commercial properties, and has been a model for others. One reason for this may be the *City of Hickory Landscape Ordinance And Tree Preservation Handbook*, a booklet that takes a developer through t development requirements in plain language. The City attempts to make compliance an easy process, allowing developers to use existing trees to fulfill their riparian buffer and landscaping requirements (City of Hickory 2008).

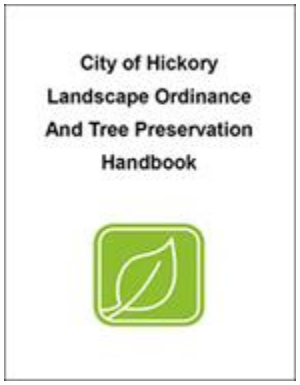

FIGURE 19. CITY OF HICKORY LANDSCAPE ORDINANCE

Partnerships

NC DFR strongly recommends employing a consulting forester, an accredited professional to oversee the entire timber operation: pre-harvest planning; oversight of forestry operations; replanting the site; timber sales and ensuring that the property owner gets the highest price for their wood. Given that the average tree stand is harvested once in a lifetime, hiring a consulting forester can be hugely important, particularly as an investment. A directory of consulting foresters for each county is available through the DFR website (NC Forest Service 2011).

Contacts

Hickory **Cal Overby** *Principal Planner* 76 N. Center St. Hickory, NC 28601 (828) 323-7487 coverby@ci.hickory.nc.us	Jamestown **Matthew Johnson** *Planning Director* 301 East Main Street PO Box 848 Jamestown, NC 27282 (336) 454-1138 mjohnson@jamestown-nc.gov
NCDFR Lexington District Forester (Davison, Davie, Forsyth, Guilford, Randolph, Rockingham, Rowan, Stokes, Surry, Yadkin) (336) 956-2111	NCDFR Mount Holly District Forester (Cabarrus, Catawba, Cleveland, Gaston, Iredell, Lincoln, Mecklenburg, Rutherford, Union) (704) 827-7576
NCDFR Urban Forestry Nancy Stairs *Program Coordinator* (919) 857-4842 nancy.stairs@ncagr.gov	

Links

Division of Land Resources Erosion and Sedimentation Program	http://www.dlr.enr.state.nc.us/pages/sedimentation_new.html
EPAs Ecosystem Services	http://www.epa.gov/ecology/
NCDENR Riparian Buffers: Frequently Asked Questions	http://portal.ncdenr.org/web/wq/swp/ws/401/riparianbuffers/faqs
NC DFR Consulting Foresters	http://www.dfr.state.nc.us/Managing_your_forest/consulting_foresters.htm
The Sustainable Sites Initiative	http://www.sustainablesites.org/
Tree City USA	http://www.arborday.org/programs/treeCityUSA/about.cfm
Urban Watershed Forestry (Center for Watershed Protection)	http://www.cwp.org/your-watershed-101/urban-watershed-forestry.html
Watershed Forestry Resource Guide	http://www.forestsforwatersheds.org/reduce-stormwater/

Publications

City of Hickory Landscape Ordinance and Tree Preservation Handbook	http://www.piedmontnutrientsourcebook.org/Assetts/forestry/Hickory handbook.pdf
Guilford County & Greensboro CITYgreen Report	http://images.www.news-record.com/files/documents/TreeCanopyFinalReport2009.pdf
NC Forest Service Forestry Leaflets	http://www.piedmontnutrientsourcebook.org/Assetts/forestry/Forestry Leaflets.pdf
NC General Stormwater Permit	http://www.piedmontnutrientsourcebook.org/Assetts/forestry/ncpermit.pdf
Randleman Lake Water Supply Watershed: Stormwater Requirements	http://www.piedmontnutrientsourcebook.org/Assetts/forestry/Randleman Nutrient Management.pdf
Town of Jamestown Tree Preservation Ordinance	http://www.jamestown-nc.us/downloads/planning/Tree_Ordinance_FINAL_Draft.pdf

8) ILLICIT DISCHARGE DETECTION AND ELIMINATION

Under the federal NPDES Phase I and II programs and many State Nutrient Management Strategies, every community must have a program to identify, address, and prevent illicit discharges. Illicit discharges are all effluents flowing into a stormwater system that aren't stormwater runoff. Paints, septic systems, greywater (i.e. washing machines), grease, waste oil, etc., are all illicit discharges.

FIGURE 20. PHOTO: CITY OF WILMINGTON, NC

Illicit discharges ("Septic" plus "Other Nonpoint" source) are estimated to be contributing 16% and 13% of the nitrogen and phosphorous loadings, respectively, into Falls Lake in the Neuse River Basin (DWQ 2011c). All North Carolina nutrient management strategies require the development of a program to detect and eliminate illicit discharges.

FIGURE 21. WASH WATER FROM A COMMERCIAL CAR WASH (EPA)

Greensboro, a NPDES Phase I city, has had an IDDE program since it began its stormwater program in 1996. It uses a proactive monitoring program in combination with an immediate response ethic to minimize illicit discharges (City of Greensboro 2011). Garner, a small city in the eastern Piedmont, has had a voluntary IDDE program since 2001 (Town of Garner 2011) in response to the nutrient management strategies governing the Neuse River Basin (DWQ 2011f).

Policies

The EPA states that a complete IDDE program includes (Center for Watershed Protection 2004a):

1. a storm sewer system map showing the locations of all outfalls;
2. ordinances that prohibit illicit discharges into the storm sewer systems and implement enforcement procedures;
3. a plan to detect and address illicit discharges, including illegal dumping; and
4. education of public employees, businesses, and the general public of hazards associated with illegal discharges.

The City of Greensboro is located in Guilford County, and has a population of about 260,000 people in 131 square miles. With over 100,000 people, it is one of six NC NPDES Phase I communities. Greensboro's Illicit Discharge and Improper Disposal Program (IDID) has implemented all elements of an IDDE program. This program has been in existence since 1996.

NCDENR Contacts

All illicit discharge monitoring and enforcement programs fall under the jurisdiction of all stormwater permits. For all specific questions regarding these requirements, please contact listed staff.

Name	Phone	E-mail	Agency
Mike Randall	919-807-6374	mike.randall@ncdenr.gov	DWQ SW Permitting
Bill Diuguid	919-807-6369	Bill.diuguid@ncdenr.gov	DWQ SW Permitting

Practices and Programs

FIGURE 22. PHOTO: ILLICT DISCHARGE ALONG ABBOTTS CREEK TRIBUTARY (PTCOG)

Greensboro's Phase I stormwater program now features over a decade in programmatic experience. The program has evolved from identifying and addressing discharges to one that is proactive and preventative in addressing potential illicit discharge sources. The IDID program educates potential polluters like painters, auto-garage repair shops, rental-equipment shops, etc., and is involved in special studies such as an aerial infrared survey, bacterial source tracking (BST), and forensic investigation of fecal coliform sources. The City has a relationship with law enforcement to report significant illicit discharges seen on the job. The City conducts smoke, dye, and video tests to track down illicit discharge sources. Greensboro has relied upon an intern program to aid them in these tracking projects, covering 10% of the City area annually.

Garner has a population of 27,138, an area of 13.6 square miles. Garner has been involved in stormwater management since the 1980s, long before any requirements. Garner has no storm water fee for its residents or businesses. The IDDE program is run by the City's stormwater engineer. Even without a stormwater fee, Garner is able to implement all four elements of a complete IDDE program.

Contact

Town of Garner **Jaclyn Sumner** *Stormwater Engineer* Stormwater Program Town of Garner 900 7th Ave. P.O. Box 446 Garner, NC 27529 (919) 772-4688 ext: 4421 jsumner@garnernc.gov	Greensboro **David Phlegar** *Water Quality Supervisor* Stormwater Management Division Greensboro Department of Water Resources 2602 S. Elm-Eugene Street Greensboro, NC 27406 (336) 373-2737 david.phlegar@greensboro-nc.gov

Links

Developing an IDDE Program	http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=111
Greensboro ICID Program	http://www.greensboro-nc.gov/departments/Water/stormwater/programs/quality/ICID.htm
Garner IDDE Program	http://www.ci.garner.nc.us/departments/Engineering/IllicitDischarge.aspx
Minimum Measure #3: Illicit Discharge Detection and Elimination	http://cfpub.epa.gov/npdes/stormwater/menuofbmps/bmp_regulatory.cfm
NPDES Program	http://cfpub.epa.gov/npdes/index.cfm
The Neuse Rules	http://portal.ncdenr.org/web/wq/ps/nps/neuse

Publications

Falls Lake Model Final Report	http://portal.ncdenr.org/c/document_library/get_file?uuid=ccb8d8f8-a74b-415f-97f9-5e5f621255e6&groupId=38364
NPDES IDDE Minimum Control Measure	http://www.piedmontnutrientsourcebook.org/Assetts/IDDE/fact2-5.pdf
IDDE: A Guidance Manual for Program Development and Technical Assessments	http://www.piedmontnutrientsourcebook.org/Assetts/IDDE/idde_manualwithappendices.pdf

9) RIPARIAN BUFFERS

Maintaining an undisturbed vegetated riparian zone can be one of the most effective ways of protecting water quality. Not only can buffers help trap, filter and process nutrients, they can also help reduce flooding, prevent erosion and provide essential wildlife habitat. A riparian buffer can also be one of the most *cost-effective* ways to improve water quality, as demonstrated by the NC Ecosystem Enhancement Program's exclusive use of riparian buffer restoration as the lowest cost method of nutrient offsets. Recognizing the value of riparian buffers to water quality, the Division of Water Quality implements Riparian Buffer Protection Rules in the Neuse River Basin, Tar-Pamlico River Basin, Catawba River Basin, Randleman Lake Watershed, Jordan Lake Watershed and Goose Creek Watershed. In addition to the State's riparian buffer rules, there are also many *local* buffer protection programs (NCDENR 2011e).

FIGURE 23. RIPARIAN BUFFER (USDA, NATIONAL RESOURCES CONSERVATION SERVICE)

Furthermore, there are other state programs that require buffers or setbacks from surface waters including Session Law 2006-246, Water Supply Watersheds, the Coastal Stormwater program, High Quality Waters, Outstanding Resource Waters and the Universal Stormwater Management program (NCDENR 2011). According to NCDENR (2011), there are also programs regulated under the Non-discharge (2T) rules with setbacks, including sewer extensions, irrigation systems and recycle systems, and the Division of Land Resources implements a buffer requirement on Trout waters.

In North Carolina, buffer rules have been established for the Neuse River Basin (15a NCAC 02b .0233), Jordan Lake Watershed (15A NCAC 02B .0267), Tar-Pamlico River Basin (15A NCAC 02B .0259), the Goose Creek Watershed (15A NCAC 02B .0607), the Catawba River Basin (15A NCAC 02B .0243), and Randleman Lake (15A NCAC 02B .0250). In general, the buffer applies to "intermittent streams, perennial streams, lakes, ponds, estuaries and modified natural streams that are depicted on the most recent published version of the soil survey map prepared by the Natural Resources Conservation Service OR the 1:24,000 scale quadrangle topographic map prepared by the U.S. Geologic Survey" (NCDENR 2011). A 50-foot buffer is a minimum requirement, although some watersheds have stronger requirements such as Goose Creek.

The State does allow some variances to Buffer Rules and most Buffer Rules include a Table of Uses which lists what uses are allowed and for what purpose (NCDENR 2011). Furthermore, some local governments are delegated to implement the State riparian buffer protection programs. A list of these local governments is available online at http://portal.ncdenr.org/web/wq/swp/ws/401/riparianbuffers/faqs#Where_are_riparian_buffer_protection_programs.

To learn more about Buffer Rules in your area, and to see if Buffer Rules apply within your municipality or jurisdiction, contact your local Division of Water Quality Regional Office or Amy Chapman in the DWQ Central Office at 919-807-6400. You can also visit DWQ's website on riparian buffer rules at http://portal.ncdenr.org/web/wq/swp/ws/401/riparianbuffers/rules.

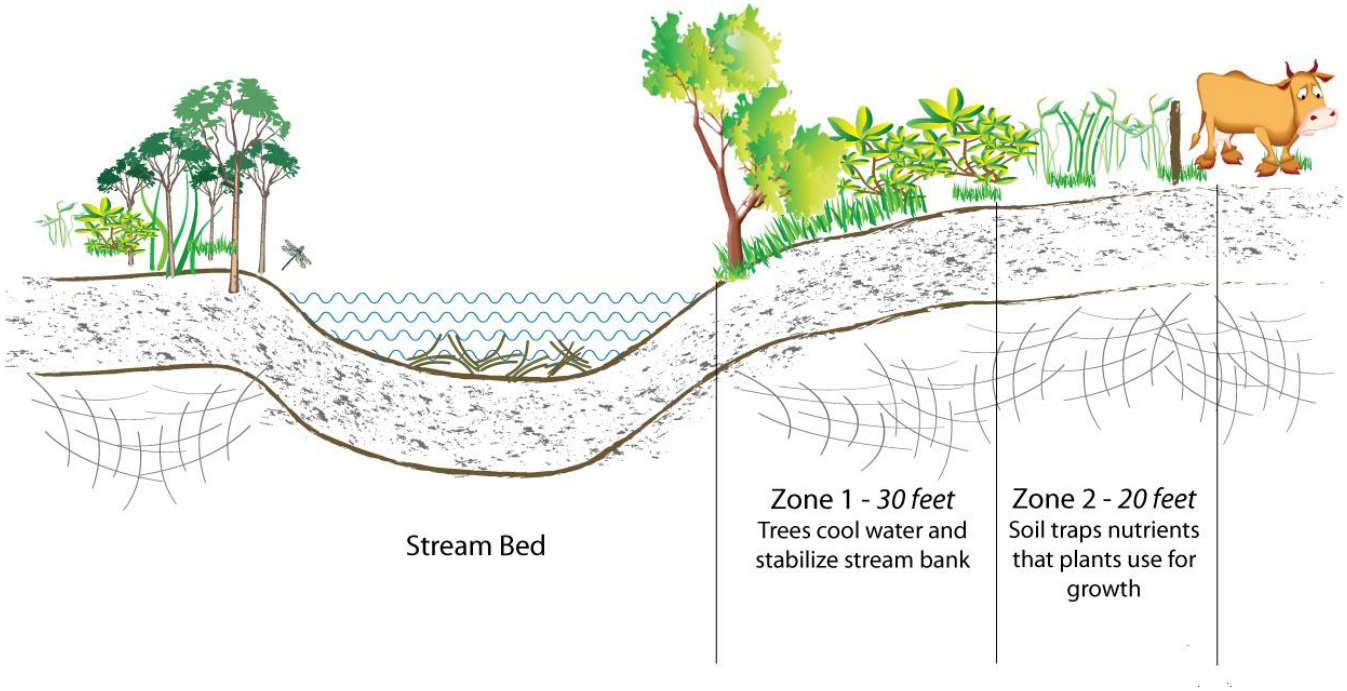

FIGURE 24. BUFFER DIAGRAM DEPICTING SOME KEY WATER QUALITY FUNCTIONS OF BUFFERS (PTCOG)

Policies

Durham's City-County Unified Development Ordinance (UDO) represents the first major overhaul of Durham's development regulations in more than 30 years and works in tandem with the newly adopted Comprehensive Plan to strengthen Durham's development regulations (City of Durham 2006). The UDO became effective on January 1, 2006, replacing the previous Zoning and Subdivision Ordinances and includes a comprehensive Environmental Protection Article which outlines its progressive riparian buffer ordinance in Section 8.5 (Riparian Buffer Protection Standards). The Riparian Buffer Protection Standards also include provisions for riparian reservoir buffers, riparian wetland buffers, buffer measurement and identification, diffuse flow requirements, maps and on-site determinations, existing use exemptions, piping streams, lots and density credits, uses, and mitigation. Please visit the UDO website for details.

NCDENR Contacts

The various riparian buffer rules and regulations throughout the state are managed by two DWQ programs addressing non-point source pollution and source water protection. Riparian buffers are required for both, and these staff will be able to answer your questions.

Name	Phone	E-mail	Agency
Amy Chapman	919-807-6400	Amy.chapman@ncdenr.gov	DWQ Wetlands & SW
Sue Homewood	336-771-4964	Sue.homewood@ncdenr.gov	DWQ Surface Water Protection

Practices

UNRBA Riparian Buffer Recommendation Sheets

The Upper Neuse River Basin Association has developed a suite of recommendation sheets (UNRBA 2011) that explain in greater detail the steps a member government might take to meet a given recommended strategy (e.g. riparian buffer management) including basic information on implementation steps, costs, funding opportunities, and potential pitfalls. Recommendation topics include everything from new development site management for nutrient reduction to stormwater control inspections to riparian buffer management that can be widely applied even in the Jordan Lake watershed. Recommendation sheets can be found in full by visiting UNRBA's website.

Programs and Partnerships

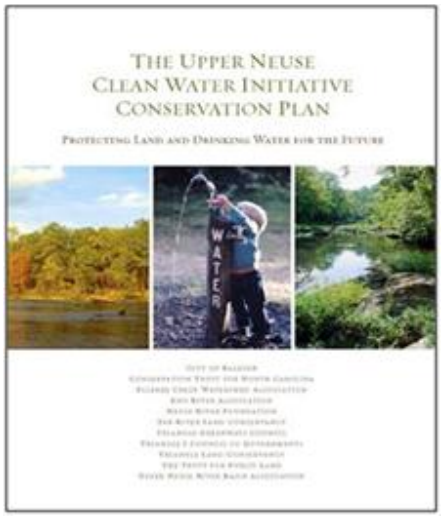

FIGURE 25. UNCWI PLAN

The Upper Neuse Clean Water Initiative (UNCWI) is a partnership effort to prioritize and protect those lands most critical for the long-term safety and health of all drinking water supplies for the communities in the Upper Neuse River Basin. The Initiative brings together landowners, conservation organizations, and local and state government programs in the Upper Neuse River Basin to protect Falls Lake, Lake Michie, Little River Reservoir, Lake Holt, Lake Orange, West Fork of the Eno Reservoir, Corporation Lake, Lake Ben Johnston, and Lake Rogers. Initiative partners work with landowners, local governments and the public to review land conservation options and acquire key parcels of land through voluntary purchase or donation of land or conservation agreements.

Contacts

City of Durham/Durham County **Sandra Wilbur** *PE, Civil Engineer III* City of Durham Public Works Department 101 City Hall Plaza, Durham, NC 27701 (919) 560-4326 Sandra.Wilbur@durhamnc.gov	Upper Neuse River Basin Association **Sarah Bruce** *Director* PO Box 12276, RTP, NC 27709 (919) 558-9343 sbruce@tjcog.org
Conservation Trust for North Carolina **Lisa Creasman** *Conservation Projects Manager* Upper Neuse Clean Water Initiative 1028 Washington Street, Raleigh, NC 27605 (919) 828-4199 (Extension 18) lisa@ctnc.org	Upper Neuse Clean Water Initiative **Heather Saunders** *Water Resources Planner* Triangle J Council of Governments PO Box 12276, RTP, NC 27709 (919) 558-9319 hsaunders@tjcog.org

Links

DWQ's Riparian Buffers Page	http://portal.ncdenr.org/web/wq/swp/ws/401/rianbuffers
UNRBA Riparian Buffer Recommendation Sheets	http://www.unrba.org/unwmp_recs.htm
The Upper Neuse Clean Water Initiative	http://www.ctnc.org/site/PageServer?pagename=prot_upperneuse

Publications

CWEP Buffers	http://nccwep.org/involvement/buffers/index.php
Durham's City-County Unified Development Ordinance	http://www.piedmontnutrientsourcebook.org/Assetts/Riparian Buffers/udo_08.pdf
Guidelines for Riparian Buffer Restoration	http://www.piedmontnutrientsourcebook.org/Assetts/Riparian Buffers/eepbuffers.pdf
Jordan Model Buffer Ordinance	http://www.piedmontnutrientsourcebook.org/Assetts/Riparian Buffers/Jordan Model Buffer Ord - Final.pdf
The Upper Neuse Clean Water Initiative Conservation Plan	http://www.ctnc.org/site/PageServer?pagename=prot_upperneuse
Upper Neuse Clean Water Initiative Fact Sheet	http://www.piedmontnutrientsourcebook.org/Assetts/Riparian Buffers/UNCWI_Fact_Sheet_2011-01.pdf
Understanding the Science Behind Riparian Forest Buffers (Virginia Tech)	http://www.piedmontnutrientsourcebook.org/Assetts/Riparian Buffers/Science Behind Buffers.pdf

10) LONG-TERM WATER QUALITY MONITORING

Consistent, long-term monitoring is important for determining water quality conditions and trends in a given water body, can be used to evaluate the effectiveness of best management practices, and is also critical for the reporting of compliance with water quality standards (but not Nutrient Management Strategies or TMDLs) (UNRBA 2011). Furthermore, participating in a monitoring coalition or partnership can bring further benefits, as articulated in the Upper Neuse River Basin Association's (UNRBA) 2006 Recommendation Sheet on long-term water quality monitoring, which suggests that "cooperative monitoring efforts produce economies of scale for participating jurisdictions and ensure more comprehensive and comparable results."

The UNRBA Recommendation Sheet continues: "…a comprehensive ongoing water quality monitoring program can help local governments to 1) establish present and/or reference watershed conditions; 2) evaluate success and performance of watershed restoration projects; 3) quantify nonpoint source (NPS) pollution during and/or after storm events (via automated stations located in strategic areas); 4) identify illicit discharges and NPS pollution sources; and 5) calibrate nutrient delivery models, which can be used to evaluate compliance…"

A thorough monitoring program should include a variety of aspects including physical, chemical and biological components. Again, the UNRBA (2006) recommends that a monitoring program include "hydrologic, suspended sediment, biological (e.g., benthic and microbial pathogen indicators), and chemical (e.g., nutrients and heavy metals) parameters."

The U.S. Geological Survey (USGS) has periodically offered support to the UNRBA as it has explored conducting ambient monitoring. USGS identified three possible strategies for watershed monitoring in the Upper Neuse River Basin that when implemented together could help protect water supply reservoirs and enable the UNRBA to analyze the effects of land use change on water quality. These strategies included (UNRBA 2011):

1) A **water supply strategy** to help assess water supply quantities, responses of reservoirs to pollutants and stressors, and effectiveness of management practices;
2) An **ecological integrity strategy** to monitor current conditions for aquatic life; and
3) A **representative streams strategy** to help establish present/reference conditions for major streams, strengthen understanding about how streams respond to stress, and aid in assessing the effectiveness of management practices.

These same strategies can be implemented elsewhere as tools for assessing water quality conditions, planning for long-term water supply, and protecting drinking water supplies and maintaining water quality standards for designated uses. Many local governments across North Carolina already

implement strategic and/or long-term water quality programs. The City of Durham has an extensive monitoring program, as well as many other municipalities in the Triangle and Triad regions. The USGS also has multiple stream flow gages across the state that provide real-time data; the USGS also conducts ambient water quality monitoring and storm sampling both for internal use and by contract for local governments and monitoring partnerships. A selection of monitoring policies, practices, programs, and partnerships is summarized in the following section.

Policies, Practices, Programs and Partnerships

The Upper Cape Fear River Basin Association (UCFRBA) is a non-profit organization and has adopted formal by-laws to guide its activities. UCFRBA's Corporate Members provide approximately $120,000 in annual funding support for its activities, including water quality monitoring. The Association provides a framework through which stakeholders can secure and pool financial resources and expertise to address issues of mutual concern, and consider, evaluate and implement cost-effective and environmentally-effective water quality monitoring, research and management strategies. The UCFRBA coordinates its activities with DWQ and has a formal Memorandum of Agreement as one of the State's monitoring coalitions.

In partnership with DWQ, the UCFRBA has established a coordinated, watershed-wide, in-stream water quality monitoring program that satisfies the in-stream monitoring requirements of participating NPDES permit holders in the Upper Cape Fear River Basin. Water quality parameters include nutrients, dissolved oxygen, pH, temperature, fecal coliforms, and several metals. Samples are taken once a month (twice per month in summer) at each station. The UCFRBA currently maintains forty (40) on-going water quality monitoring station locations throughout the Upper Cape Fear Basin (i.e Haw and Deep River watersheds).

The New Hope Arm Working Group is an informal work group made up of local government representatives. This group is interested in long-term water quality and flow monitoring to assist with meeting the goals and nutrient reduction targets established by the Jordan Lake Rules. This group is currently inactive as the NSAB works through its recommendations, but may begin actively meeting again once the NSAB concludes it work. For more information, please contact Patrica D'Arconte, Stormwater Technician/Stream Ecologist for the Town of Chapel Hill.

The Triangle Area Water Supply Monitoring Project (TAWSMP) is a cooperative effort of local governments in the six-county greater Research Triangle region within the Upper Cape Fear and Upper Neuse River Basins. Between 1990 and 1999, the population in the Triangle Area increased by 30 percent, and the continued growth has increased the need for public water supplies. Seventy-seven percent of the households in the region depend on water supplies drawn from streams and lakes. Two large multipurpose reservoirs, eight smaller reservoirs, and six rivers supply water for the 30 municipalities in the area. Because of this reliance on surface water for water supply and the potential

impact of growth on the quality of the region's water supply sources, local governments in the region recognized that water-quality monitoring is crucial to the protection of the Triangle Area's surface-water resources. In 1988, a group of local governments in the six-county region, with assistance from Triangle J Council of Governments (TJCOG) formed the ***Triangle Area Water Supply Monitoring Project*** to systematically evaluate the quality of several water-supply sources in the region.

NCDENR Contacts

The standards for collecting water quality data can be addressed by Environmental Sciences staff. How that data is used to make decisions on water quality rules and regulations can be answered by TMDL Unit staff.

Name	Phone	E-mail	Agency
Jay Sauber	919-743-8416	Jay.sauber@ncdenr.gov	DWQ Env. Sciences
Kathy Stecker	919-807-6422	Kathy.stecker@ncdenr.gov	DWQ TMDL Unit

With assistance from the USGS, the TAWSMP has collected and analyzed water-quality samples from reservoirs and streams and collected continuous discharge records from streams in the study area for more than 20 years. These data, along with data collected by the North Carolina Division of Water Quality (DWQ) and with data collected as part of a program of the USGS, the U.S. Army Corps of Engineers, and the City of Durham, form a long-term comprehensive record of the quality of many of the area's water-supply reservoirs and rivers, and selected tributaries to those water supplies.

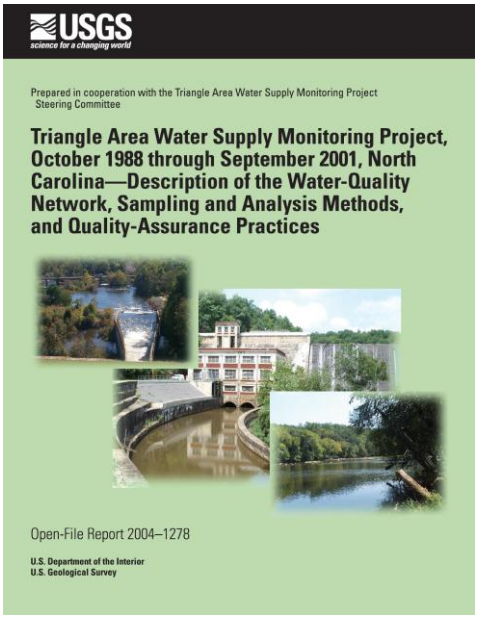

FIGURE 26. USGS TAWSMP MONITORING REPORT

In the last 20 years, concerns about water quality of the area's water supplies and the impact of development on reservoir eutrophication and contaminant concentrations have remained prominent, although specific concerns have changed. Monitoring initially focused on determining the occurrence of synthetic organic compounds in the water column and bed sediments; later monitoring and interpretive efforts focused on nutrient and sediment loads and trends. Issues such as the occurrence of disinfection by-products, microbial pathogens, and pharmaceutical and personal care products have also been addressed.

Data collection began in October 1988 and is ongoing. A key strength of the monitoring program has been the long-term consistency of data collection locations, constituents, and sampling methods. This

was recognized during a workshop in December 1997 that was attended by a diverse group of scientists and government agency staff who were asked to review progress and design of the project.

UNRBA Long-Term Planning and Regulatory Nutrient Management Activities in the Falls Lake Watershed is an effort of the UNRBA that will get underway in 2012. The purpose of the project is to develop "methods by which the regulatory framework associated with the recently adopted Falls Lake Nutrient Management Rules can be evaluated" (UNRBA 2011). The project is expected to produce a detailed monitoring and modeling plan, which will include an evaluation of existing monitoring efforts. Local governments may want to follow this process for information on water quality monitoring for nutrient management and the use of monitoring data to evaluate or inform rules. For more information on this project, contact Sarah Bruce, Director of the UNRBA, at (919) 558-9343 or by email at sbruce@tjcog.org.

TJCOG Upper Neuse River Basin Water Quality Monitoring Plan is a current TJCOG grant-funded project to develop agreement on a long-term monitoring framework to answer questions about nutrient management in the Upper Neuse River Basin. This project aims to develop recommendations to help stakeholders identify sources of nutrients in terms of land use, actual source (e.g. residential properties may have more than one type of nutrient source such as dog waste, fertilizer, and grass clippings, and geography as well as evaluate the effectiveness of management strategies implemented at the site level. One major outcome of this process (scheduled to be completed in September of 2012) will be a report describing a comprehensive monitoring framework for waterways in the Upper Neuse River Basin and a set of monitoring design guidelines collaboratively developed that addresses discrete monitoring objectives. The monitoring design guidelines will include recommendations for sampling parameters, monitoring frequencies, monitoring locations, and partnerships as well as considerations for QAPP/QAQC procedures and archiving and reporting protocols. For more information about this process, contact Heather Saunders, Water Resources Planner at TJCOG, at (919) 558-9319 or by email at hsaunders@tjcog.org.

Contacts

Upper Cape Fear River Basin Association **Cy Stober** *Water Resources Manager* Piedmont Triad Regional Council 2216 West Meadowview Road Suite 201 Greensboro, NC 27407 cstober@ptrc.org(336) 294-4950	New Hope Arm Working Group **Patricia D'Arconte** *Stormwater Technician* Town of Chapel Hill 208 N. Columbia Street Chapel Hill, NC 27514 pdarconte@townofchapelhill.org (919) 969-7202
Triangle Area Water Supply Monitoring Project **Heather Saunders** *Water Resources Planner* Administrative Support Staff Triangle J Council of Governments PO Box 12276, RTP, NC 27709 hsaunders@tjcog.org (919) 558-9319	DWQ Monitoring Coalition Program **Carrie Ruhlman** *Coalition Coordinator* NC Division of Water Quality Environmental Sciences Section 1621 Mail Service Center Raleigh, NC 27699-1621 carrie.ruhlman@ncdenr.gov (919) 743-8411

Links

City of Durham	http://www.ci.durham.nc.us/departments/works/stormwater.cfm
DWQ	http://portal.ncdenr.org/web/wq
DWQ Basinwide Planning Unit	http://portal.ncdenr.org/web/wq/ps/bpu
Triangle Area Water Supply Monitoring Project	http://nc.water.usgs.gov/triangle/
Triangle J Council of Governments (TJCOG)	http://www.tjcog.dst.nc.us/
U.S. Geological Survey	http://www.usgs.gov/
Upper Cape Fear River Basin Association	http://www.cfra-nc.org/ucfrba.htm
Upper Neuse River Basin Association	http://www.unrba.org/
TJCOG Upper Neuse River Basin Monitoring Plan	http://upperneusewqmonitorng.wikispaces.com/

11) WATERSHED RESTORATION PLANNING

One way to think of national (i.e. Chesapeake Bay Program) and NC (i.e. Jordan Lake Rules) nutrient management strategies is that they are giant watershed restoration plans. What makes meeting the goals of these programs challenging are many of the same concerns that are challenging in smaller watersheds: a history of poor watershed stewardship; developed headwaters; and the emerging data regarding best management practices for watershed restoration. Watershed restoration clearly demonstrates the value of prevention versus remediation. The USEPA recently recognized this protection need with their Healthy Watersheds Initiative (EPA 2011f).

FIGURE 27. EROSION ALONG ABBOTTS CREEK IN DAVIDSON COUNTY

Watershed restoration begins with planning. A watershed plan identifies impacts to the watershed (e.g. highly-eroding/unstable stream banks), specific system stressors (e.g. high peak flows), and potential causes (agricultural or urban stormwater runoff). Watershed restoration seeks to improve the watershed's ability to provide clean water, stable hydrology and adequate aquatic and terrestrial habitat. Watershed restoration involves identifying watershed impacts, stressors and sources and implementing restoration projects to remediate stressors and improve functioning. Restoration planning also identifies potential restoration sites to improve watershed functions.

As communities, states, and the USEPA's understanding of water quality management needs and how to best serve them through management voluntary and mandated watershed management strategies and TMDLs, opportunities to conserve costs will become more apparent. Many small streams must contend with local sources of pollution impairing their uses and ecological support, and these concerns demand local analysis and solutions. However, these same actions and investments will have benefits downstream that must be accounted for. To use examples from the following section, restoration and retrofit investments within the Lick Creek watershed or the Rich Fork Creek watershed will have some downstream benefits to Falls Lake and High Rock Lake, respectively. While the value of these actions is most immediately realized locally, the downstream benefits for all reservoir stakeholders must be realized at the local, state, and federal levels in how we most cost-effectively progress with watershed management and water quality restoration efforts.

Policies

FIGURE 28. SWIFT CREEK IN WAKE COUNTY (UNRBA)

While no explicit policies dictate *how* watershed restoration must be done, federal and state policies do require actions to improve water quality that can best be described as watershed restoration*. The federal Clean Water Act (CWA) of 1972 mandates that all "waters of the US" be protected for the environment and public health (EPA 2011g). The CWA requires the states to regularly monitor water quality conditions for ecological health and human uses. If a water body is determined to be failing to support these needs, it is placed on the 303(d) list of impaired waters. This list identifies the water body, where it is, and the known sources of pollution. Once on the 303(d) list, a restoration plan or a Total Maximum Daily Load assessment must be done within 13 years to address the sources of pollution that flow to that water body. States are mandated to update the 303(d) list every two years (DWQ 2011g).

Under the Clean Water Act, states are mandated to develop appropriate water quality standards. North Carolina has done so in the "Redbook" (15A NCAC 2B), state administrative code that regulates water quality monitoring, addressing impaired waters, and exceptional waterbodies that receive additional protections (drinking water, trout waters, etc.) (DWQ 2007). The N.C. Division of Water Quality is the agency responsible for monitoring local government compliance with water quality regulations found in the Redbook.

The USEPA offers all watershed communities Nine Key Elements of a Local Watershed Plan that detail some minimum goals that every watershed planning effort should include to be considered successful and comprehensive (USEPA 2008). These elements are also required to be eligible for any federal grants or assistance in watershed restoration planning. They are:

1. Identification of the causes and sources of pollution
2. Estimation of the pollutant reductions due to watershed management
3. Description of the non-point source management measures most needed to improve watershed conditions
4. Estimation of the technical and financial needs for successful watershed restoration
5. Education of the public as to why watershed restoration is important and valuable to them
6. Creation of an implementation schedule for watershed restoration
7. Identification of milestones in watershed restoration that will signify successful remediation
8. Monitoring to determine if restoration efforts are benefitting water quality
9. Development of indicators that will establish watershed improvements

**Exceptions include circumstances where a point source discharge is directly polluting a body of water or atmospheric deposition of pollutants, a non-point source that is an emerging issue that requires employment of the Clean Air Act to fulfill the requirements of the Clean Water Act. Point sources of pollution are a rare occurrence anymore, due to the National Pollutant Discharge Elimination System permitting program. The national mercury concerns and impairments are the most dramatic example of atmospheric deposition of pollutants.*

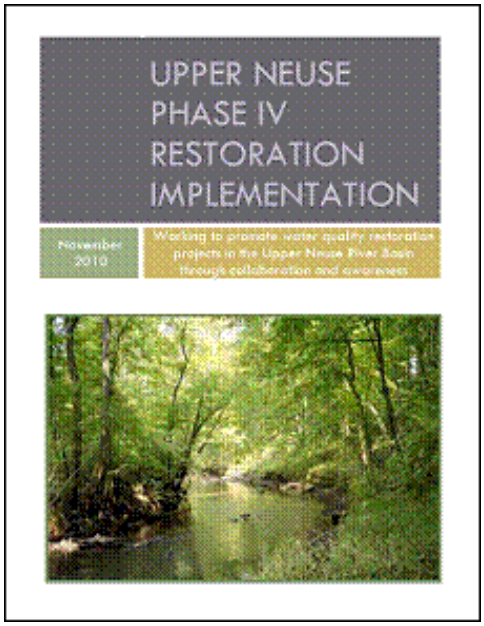

FIGURE 29. UPPER NEUSE PHASE IV RESTORATION IMPLEMENTATION

Practices

Watershed restoration planning shows that small investments can have huge impacts. Protecting wetlands and stream buffers is one of the most cost-effective methods for restoring and protecting water quality. Protecting headwater streams and wetlands offers exponential benefits for downstream waters and communities. Some of the most dramatic watershed restoration projects (retrofitting parks to include wetlands; stream restorations; etc.) will be undone if stormwater management in at local headwaters are not addressed early on.

Regulations and policies local governments apply to land use and development also indicate a watershed's health. If policies fail to acknowledge the impacts of development and land use upon a watershed, then the public will be unaware of these issues. The argument against such ordinances is that they are unfriendly to development. The irony of avoiding these measures is that the private sector will profit while tax-paying residents will almost surely have to pay for restoring the watershed.

Approaching watershed restoration with policies, programs, and projects may be best seen in the efforts led by the Upper Neuse River Basin Association (UNRBA) in Wake and Durham Counties, and in the work of the Piedmont Triad Council of Governments (PTCOG) in the Davidson County tributaries to High Rock Lake.

The Neuse River is under a nutrient management strategy to reduce chlorophyll-*a* levels. All communities in this river basin must reduce their nitrogen loads by 30% (DWQ 2011f). Many of these creeks are also in the Falls Lake watershed, which essentially encompasses the entire Upper Neuse River Basin. Falls Lake is also under a nutrient management strategy to reduce nitrogen and phosphorous levels by 40% and 77%, respectively (DWQ 2011c).

UNRBA has collaborated with the North Carolina Ecosystem Enhancement Program (NC EEP) and been awarded 319 funds to address five impaired tributary watersheds of the Upper Neuse River Basin: Ellerbe, Ledge, Lick, Little Lick, and Upper Swift Creeks. They have applied the USEPA local watershed planning approach to these waterbodies, and since collected all of these plans into a summary strategy to address water quality in the urbanized headwaters of the Neuse River.

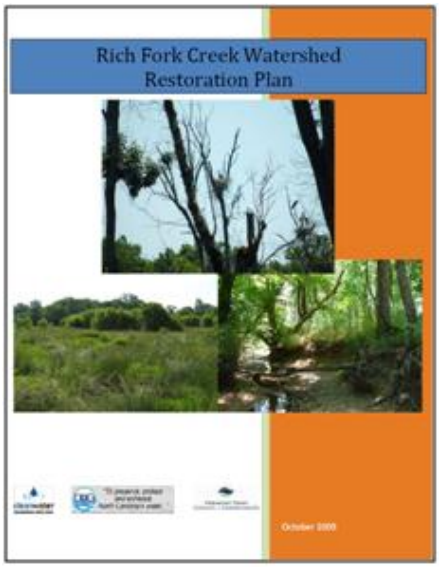

FIGURE 30. RICH FORK CREEK WATERSHED RESTORATION PLAN

PTCOG has been awarded The Clean Water Management Trust Fund (CWMTF) and 319 funds to work with Davidson County and the Cities of High Point, Lexington, and Thomasville to address the impaired High Rock Lake tributaries Rich Fork, Hamby, North Hamby, Hunts Fork, Abbotts, and Swearing Creeks. High Rock Lake is undergoing a TMDL assessment for chlorophyll-*a*. Once complete, the local watershed plans will address all of the sources of impairment to these streams and the Lake.

Programs

Many principles of watershed planning are taken from the Center for Watershed Protection (CWP), which focuses its efforts on Maryland and the Chesapeake Bay Watershed. Chesapeake Bay is in danger of losing its incredibly diverse biology due to historical insults to Bay ecology (especially the loss of the ecologically-valuable oyster reefs), the high levels of development around Washington, D.C., and intensive agricultural use. The CWP is widely considered the most reliable resource available to watershed planners, managers, and stakeholders for consultation in how to address a watershed's sources of pollution and how to best address them. They regularly support and publish emerging research on both watershed protection and restoration, and offer this research at regular Watershed Institutes held nationally. The CWP has also adopted watershed planning efforts throughout the country to test their hypotheses, including an effort in Lick Creek, Durham County, NC (UNRBA 2009).

The N.C. Division of Water Quality utilizes some of the research of the CWP and guidelines from USEPA through a couple of programs. The division supports local watershed planning and/or the development of Total Maximum Daily Loads (TMDLs) that identify and quantify the current sources of pollution in a watershed through its 319 Grant Program. This is a federal grant program that allocates funds to every state to address polluted waters and watersheds through comprehensive planning that fulfills the USEPA's Nine Key Elements of Local Watershed Planning.

North Carolina also addresses these needs through the NC EEP, a division of NCDENR created to offset the impacts of NC Department of Transportation (DOT) projects to streams and wetlands. So long as

the project remains within the watershed affected by the DOT project, NC EEP can invest public funds to improve watershed conditions. This mitigation also usually requires NC DOT to offset the impact by a ratio to improve more than what was disturbed, so the potential ecological benefits could outweigh the degradation of state-funded transportation project. EEP funds multi-phased local watershed plans that identify projects that can best improve watershed conditions, and then often will follow up on this plan by investing in several projects using state monies. The benefits of partnering with NC EEP may best be seen in its collaboration with the City of Charlotte and Centralina COG in the Goose Creek watershed (Charlotte-Mecklenburg Stormwater Services 2009).

The CWMTF also provides significant resources and funding to watershed stakeholders interested in watershed restoration planning. The CWMTF is allocated funds by the NC General Assembly, and has historically received an average of $50 million to support local water quality efforts. The CWMTF financially supports all aspects of watershed restoration, from planning and pollutant source identification to implementing stormwater retrofit and stream restoration projects.

NCDENR Contacts

NC DWQ Basinwide Planning staff conduct watershed and river basin planning projects to guide prioritization for restoration and protection efforts statewide. They are using the best available technology to address these needs, and can tell you how local efforts will be incorporated into these plans, and how these plans can affect local communities.

Name	Phone	E-mail	Agency
Paul Clark	919-807-6443	Paul.clark@ncdenr.gov	DWQ Basinwide Planning (BP)
Nora Deamer	919-807-6431	Nora.deamer@ncdenr.gov	DWQ BP (Cape Fear River; Neuse River)
Heather Patt	919-807-6448	Heather.patt@ncdenr.gov	DWQ BP (Yadkin-Pee Dee River)
Melanie Williams	919-807-6447	Melanie.williams@ncdenr.gov	DWQ BP (Roanoke River)

Partnerships

North Carolina has a number of resources and agencies available for watershed planning and restoration needs. A number of knowledgeable and resourceful environmental groups are available for watershed planning assistance in North Carolina, especially to ensure that all planning efforts address environmental needs and ensure environmental sustainability. Please refer to the charts at the bottom of the page for examples of all of the organizations involved with the UNRBA and PTCOG watershed planning efforts. CWMTF and the 319 program at DWQ are both vital funding sources for

watershed planning and plan implementation grants. Their funding is dependent upon NC General Assembly allocations – directly in the case of CWMTF and indirectly in the case of 319 – and therefore is variable year to year.

The NC Department of Environment and Natural Resources has a Division of Forest Resources (DFR) that has a legacy of researching forestry practices that protect watersheds, and developing Forestry Practice Guidelines (FPGs) that reflect these findings. The DFR has more recently taken an active interest in both urban forestry and ecosystem services of forested watersheds and public areas. Research has shown that forest cover improves air quality, water quality, public health, and mental health, and NC DFR is an emerging agency in examining these aspects of the current forest cover in NC, as well as the potential for urban centers to improve their forest cover.

NCSU's Water Quality Group (WQG) is also an enormously valuable resource for NC watershed communities. An offshoot of the Cooperative Extension service, the WQG provides local governments access to the cutting-edge research the Biological and Agricultural Engineering Department (BAE) is doing on both watershed restoration planning and implementing those plans through stormwater retrofits and stream and wetland restorations. The work done by the BAE scientists and academics is among the best and newest in the country, and is specifically geared to the needs of NC, including the watershed management challenges of the piedmont.

The NC Wildlife Resources Commission is a publicly-funded entity that mission is "to conserve North Carolina's wildlife resources and their habitats and provide programs and opportunities that allow hunters, anglers, boaters and other outdoor enthusiasts to enjoy wildlife-associated recreation." Their input is particularly valuable with regard to protecting rare and endangered species, restoring their habitat, and/or the economic benefits of healthy watersheds.

FIGURE 31. PHOTO: NC WILDLIFE RESOURCES COMMISSION

The Conservation Trust of NC (CTNC) is a non-profit invested in "…preserv[ing] our natural resources as a legacy for the people who love North Carolina now and in generations to come" and actively partners with diverse organizations and individuals to ensure that they serve this mission. They recently worked with the Trust for Public Land to demonstrate that the lands and waters in North Carolina are returning $4 in benefits for every dollar invested in their restoration and/or protection.

The Waterkeeper Alliance is a national non-profit that promotes grassroots advocacy to clean up rivers, streams, lakes, and coastal waters. The NC chapter is active primarily through its Riverkeepers in the Cape Fear, Catawba, French Broad, Haw, Upper Neuse, Lower Neuse, Pamlico-Tar, Upper Watauga, White Oak-New, Yadkin River basins. These advocates all work on campaigns independently, and have unique relationships with river basin stakeholders, and can be a powerful asset in addressing watershed and water quality needs.

As mentioned in the Programs section, there are Councils of Governments throughout NC that offer water resources planning services, with expertise in watershed restoration. Notable watershed planning efforts have undertaken by the High Country, Land-Of-Sky, Isothermal, Western Piedmont, Centralina, Piedmont Triad, Lumber River, and the Triangle J Councils of Governments. COGs directly serve the needs of their member governments, and frequently gather counties, towns, and cities together to address watershed concerns. Most of these efforts are grant-funded efforts, and at a minimal cost to local governments, unlike consultant contracts. Please contact your local Water Resources professional for further details on how your COG can address your watershed planning and water resources needs.

Contacts

Piedmont Triad Regional Council Cy Stober *Water Resources Manager* Wilmington Building, Suite 201 2216 W. Meadowview Road Greensboro, NC 27407 (336) 294-4950 cstober@ptrc.org	Triangle J Council of Government Heather Saunders *Water Resources Planner* P O Box 12276 Research Triangle Park, NC 27709 (919) 558-9319 hsaunders@tjcog.org

Links

Abbotts Creek Watershed Restoration Plan	http://www.ptcog.org/planning_services/environmental_planning/water_resources/water_quality/abbotts_creek.php
Center for Watershed Protection	http://www.cwp.org/
Chesapeake Bay Program	http://www.chesapeakebay.net/chlorophylla.aspx?menuitem=14655
Clean Water Management Trust Fund	http://www.cwmtf.net/
Conservation Trust of NC	http://portal.ncdenr.org/web/wq/ps/mtu/specialstudies
High Rock Lake TMDL	http://portal.ncdenr.org/web/wq/ps/mtu/specialstudies
NC Department of Transportation (DOT)	http://www.ncdot.org/doh/preconstruct/pe/neu/NEUProcedures/NCDOT_EEP.html
NC Division of Forest Resources	http://www.nceep.net/
NC Ecosystem Enhancement Program	http://www.nceep.net/
NC Nonpoint Source 319 Grant Program	http://portal.ncdenr.org/web/wq/ps/nps/319program
NC TMDL Program	http://water.epa.gov/polwaste/nps/handbook_index.cfm
NC Wildlife Resources Commission	http://www.ncwildlife.org/
NCSU's Water Quality Group	http://water.epa.gov/polwaste/nps/handbook_index.cfm
USEPA: Nine Key Elements of Local Watershed Planning	http://water.epa.gov/polwaste/nps/handbook_index.cfm
Upper Neuse River Basin Association (UNRBA)	http://www.unrba.org/
Piedmont Triad Council of Governments (PTCOG)	http://www.ptcog.org/planning_services/environmental_planning/water_resources/index.php
Rich Fork Creek Watershed Restoration Plan	http://www.ptcog.org/planning_services/environmental_planning/water_resources/water_quality/rich_fork_creek.php
The Waterkeeper Alliance	http://www.waterkeeper.org/

Councils of Government

Councils of Government	http://www.regiond.org/
High Country	http://www.regiond.org/
Land-Of-Sky	http://www.landofsky.org/
Isothermal	http://www.regionc.org/IPDC/web.cfm?CID=324
Western Piedmont	http://www.wpcog.org/
Centralina	http://www.centralina.org/
Piedmont Triad	http://www.ptcog.org/planning_services/environmental_planning/water_resources/water_quality/rich_fork_creek.php
Lumber River	http://www.lumberrivercog.org/
Triangle J Councils of Governments	http://www.tjcog.org/

Publications

Lick Creek Watershed Restoration Plan	http://www.piedmontnutrientsourcebook.org/Assetts/Watershed Restoration/GooseCreek_147_2005_RP.pdf
Goose Creek Watershed Restoration Plan	http://www.piedmontnutrientsourcebook.org/Assetts/Watershed Restoration/GooseCreek_147_2005_RP.pdf
High Rock Lake Nutrient Management	http://www.piedmontnutrientsourcebook.org/Assetts/Watershed Restoration/HRL_nut-mgmt.pdf
NC Redbook	http://www.piedmontnutrientsourcebook.org/Assetts/Watershed Restoration/2007RedbookOnline.pdf
Upper Neuse Phase IV Restoration Implementation	http://www.piedmontnutrientsourcebook.org/Assetts/Watershed Restoration/FINAL_Neuse_PhaseIV_Report_21Dec.pdf
Rich Fork Creek Watershed Restoration Plan	http://www.piedmontnutrientsourcebook.org/Assetts/Watershed Restoration/RFCRestorationPlan.pdf

12) TARGETED LAND ACQUISITION AND CONSERVATION EASEMENTS

Conservation of land around surface waters is perhaps the most cost-effective and long-term water quality protection strategies available.

FIGURE 32. PHOTO: CONSERVATION TRUST FOR NORTH CAROLINA (LINK)

Riparian Buffers

Protection of vegetated riparian buffers along headwater streams, tributaries, and lakeshores provides natural and effective protection against nonpoint source pollutants and reduces future impacts from additional development. Furthermore, protected riparian buffers provide significant nutrient removal and stream protection functions, can help with flooding, and are important for wildlife habitat. Protection of the nutrient removal and other water quality benefits provided by riparian buffers throughout the watershed are important elements of the Jordan Lake, Neuse River, and Tar-Pamlico River nutrient management strategies. Additionally, riparian buffers and conserved land areas may be expected to help protect water supply uses of designated water supplies throughout the watersheds.

Targeted Land Acquisition and Conservation Easements

The Upper Neuse Watershed Management Plan (Tetra Tech 2003) recommends that local governments perform an inventory of lands that are considered critical for water quality and/or habitat protection, and work to conserve them through grants or conservation easements. The Upper Neuse Clean Water Initiative is a partnership that prioritizes lands for conservation that are considered critically important to water quality. A further description of the project is provided below. Piedmont Triad Regional Council has also developed a land conservation and restoration prioritization scheme for the Dan River Basin and is now pursuing this work in the Yadkin-Pee Dee Basin. And TJCOG was recently awarded grant funds to perform this work in the Upper Cape Fear River Basin. See below for more details.

Policies and Practices

UNRBA "Target Land Acquisition and Conservation Easements" Recommendation Sheet

The Upper Neuse River Basin Association (UNRBA) has developed a suite of recommendation sheets (UNRBA 2011) that explain in greater detail the steps a member local government might take to meet a given recommended strategy (e.g. targeted land acquisition) including basic information on implementation steps, costs, funding opportunities, and potential pitfalls. Recommendation topics include everything from new development site management for nutrient reduction to stormwater

control inspections to targeted land acquisition that can be widely applied even in the Jordan Lake watershed. Recommendation sheets can be found in full by visiting UNRBA's website.

Transfer of Development Rights

Orange County has been conducting a feasibility study (Orange County 2011) of creating a Transfer of Development Rights (TDR) program for its residents. A full project description is available on the Orange County website and an abbreviated description of the program is provided on the following page.

"Transfer of Development Rights (TDR) programs work by creating a market for credits that are bought and sold by property owners and developers. The three main concepts that must be understood are sending areas, receiving areas, and TDR credits: Sending Areas are those areas that the County would like to see protected and conserved in the future. This could be prime farmland, open space, forests, water supply watersheds, wetlands, historic places, or any other area that has important natural or man-made features. TDR programs were initially started in New York to protect historic landmarks, but are now being used by over 100 municipalities and counties across the country. Landowners in sending areas are allowed to continue using their land for the same uses as long as development density is not increased; foregoing the ability to increase density for development is compensated through the purchase of TDR credits. Receiving Areas are places that have the capacity to accommodate new development. In order to build at higher densities than the current regulations allow, a developer must purchase TDR credits obtained from a sending area landowner. This arrangement can allow transit and other non-automobile modes of travel to work better in these areas as well as foster revitalization" (Orange County 2011).

FIGURE 33. ORANGE COUNTY TRANSFER OF DEVELOPMENT RIGHTS (LINK)

NCDENR Contacts

NCDENR has several programs that address conservation in the state, and how protecting open spaces and natural habitats can benefit water quality. The Ecosystem Enhancement Program applies this knowledge to offset the impacts of NC Department of Transportation projects.

Name	Phone	E-mail	Agency
Allison Weakley	919-707-8629	Allison.weakley@ncdenr.gov	One NC Naturally
Stephanie Horton	919-715-1263	Stephanie.horton@ncdenr.gov	NC EEP

Programs and Partnerships

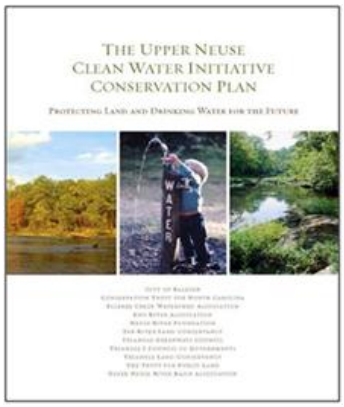

FIGURE 34. UPPER NEUSE CLEAN WATER INITIATIVE PLAN

The Upper Neuse Clean Water Initiative (UNCWI) is a partnership effort to prioritize and protect those lands most critical for the long-term safety and health of all drinking water supplies for the communities in the Upper Neuse River Basin.

The Initiative brings together landowners, conservation organizations, and local and state government programs in the Upper Neuse River Basin to protect Falls Lake, Lake Michie, Little River Reservoir, Lake Holt, Lake Orange, West Fork of the Eno Reservoir, Corporation Lake, Lake Ben Johnston, and Lake Rogers. Initiative partners work with landowners, local governments and the public to review land conservation options and acquire key parcels of land through voluntary purchase or donation of land or conservation agreements.

Dan River, Yadkin Pee-Dee and Upper Cape Fear River Basin Restoration Analysis & Strategies

The Piedmont Triad Regional council has been leading efforts to collect environmental, economic, and recreational data from both North Carolina and Virginia to inform a GIS-based assessment of the Dan River and Yadkin/Pee-Dee River Basins restoration priorities. The final output of these efforts is a document and a website that synthesizes the data across states (where applicable) and both USEPA regional offices and recommends more focused and immediate attentions for both conservation and restoration in each 12-digit hydrologic unit code (HUC) watershed.

In partnership with PTRC, TJCOG has recently been awarded funds to pursue a conservation and restoration analysis for the Upper Cape Fear River Basin.

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Upper Neuse Clean Water Initiative **Heather Saunders** *Water Resources Planner* Triangle J Council of Governments PO Box 12276, RTP, NC 27709 (919) 558-9319 hsaunders@tjcog.org	

Links

Conservation Trust for North Carolina	http://www.ctnc.org/site/PageServer
Orange County Transfer of Development Rights	http://www.co.orange.nc.us/planning/TDR_files/TDR_Overview_Brochure2.pdf
The Upper Neuse Clean Water Initiative	http://www.ctnc.org/site/PageServer?pagename=prot_upperneuse

13) OUTREACH, EDUCATION, AND PUBLIC PARTICIPATION

FIGURE 35. KIDS HAVING FUN WITH AN ENVIROSCAPE

Many local governments are regulated to develop and implement a public education program addressing stormwater runoff. These programs complement the non-structural and structural BMPs required by the NPDES MS4 program and many State Nutrient Management Strategies. Non-structural BMPs reduce pollution at the source with devices such as street sweeping, pet waste cleanup, and land use planning rather than through costly end-of-pipe structures like bioretention cells. Public education very effectively serves these investments, enhancing community awareness of their purpose and need, and, ideally, creating a sense of community investment in their local watershed health. Education programs are less expensive and often easier to design and implement than BMPs(DWQ 2007a).

Most programs require public education and participation which may be executed by the local government or through partnerships with other organizations. Successful programs include a combination of mass media, direct education and public participation.

Most current stormwater education programs began in response to National Pollution Discharge Elimination System (NPDES) Phase I or Phase II requirements (EPA 2011d) or legislation including the Tar-Pam (DWQ 2001) and Neuse Rules (DWQ 2011f). Programs are typically funded through a stormwater utility fee or out of the general fund.

Many program coordinators hold North Carolina Environmental Education Certification. The certification is a valuable tool and highly recommend for successful outreach and education program coordinators.

Jurisdictions developing an outreach program should take advantage of the wide variety of free educational materials and local program resources available through the North Carolina stormwater outreach and education program. Additional materials are available through various governmental and nonprofit organizations and can be customized for a target audience.

For more information on developing and evaluating campaigns, read the Clean Water Education Partnership (CWEP) publication "A Review of Research Relevant to Evaluating Social Marketing Mass Media Campaigns."

Policies

Any public education program should inform the public of the impacts of nutrient loading and measures that can be taken to reduce their impact. Public participation is an integral part of a successful program and every effort should be made to involve citizens through participation on advisory groups or through hands on projects including water quality monitoring and storm drain marking.

The following list identifies additional strategies and programs found in outreach, education and public participation programs:

- Newspaper articles and/or inserts
- Kiosks and signage
- Direct mail
- Displays at the point-of-purchase in retail centers
- Utility bill inserts
- Public meetings
- Community events
- Contest
- Storm drain marking
- Stream and Litter cleanups
- Group presentation and/or speeches
- News coverage
- Workshops and classroom outreach
- Distributing promotional giveaways and specialty items
- Brochures, displays, signs, welcome packets and pamphlets
- Local cable access
- Newsletters

NCDENR Contacts

NCDENR's Stormwater Permitting program has a fulltime staff to advise communities on how they can meet all federal and state legislation regarding water quality that mandates public involvement and outreach. Please contact them for what is required as well as what resources are available for your community's needs.

Name	Phone	E-mail	Agency
Bridget Munger	919-807-6363	Bridget.munger@ncdenr.gov	DWQ SW Permitting

Practices

Most education programs contain similar outreach components. These include an informational website, brochures, educational booths at fairs and festivals, presentations to community organizations, a storm drain marking program, participation in the NC StreamWatch or other Adopt-a-Stream program, and participation in NC Big Sweep and other stream cleanup initiatives. Many programs place a heavy emphasize on classroom presentations. Although 5th and 8th grade curriculums target watershed and stormwater education, many educators branch out to other grade levels as well. Programs directed at younger students helps establish an emotional connection leading them to be better stewards of their environment in the future, while high school students have the ability and enthusiasm to make changes now.

FIGURE 36. EIGHTH GRADE STUDENTS PARTICIPATE IN AN ENVIROSCAPE PRESENTATION

The City of Wilmington has an exceptional school program, reaching all eighth grade classrooms in their jurisdiction. Their eighth grade Enviroscape ® program meets many objectives for 8th grade science Standard Course of Study. The Enviroscape® is a scaled-down model of a watershed that helps students visualize stormwater runoff, water pollution, water quality, watersheds, and stewardship.

Partnerships

The majority of local governments participate in a regional water quality education program. Depending on the type of program available in each jurisdiction, local governments can fulfill some or all of their requirements through a cooperative agreement (e.g., Council of Government).

Many jurisdictions accomplish some of these elements through participating in a partnership program like the Clean Water Education Partnership (CWEP) in the Triangle or Stormwater SMART in the

Piedmont Triad. Both programs are sponsored by Councils of Government. The Piedmont Triad Water Quality Partnership also meet some regulatory requirements, but is not specifically focused on nutrient reduction.

The Chapel Hill Stormwater Management Program partnered with the UNC Institute for the Environment to address illicit discharge from restaurants in their community. This unique partnership used focus groups to understand how citizens most identified with their watershed. The information was used to create a Spanish-language video and accompanying signage that connects family health to protecting Jordan Lake and its recreational opportunities (Town of Chapel Hill & UNC-Chapel Hill's Institute for the Environment 2010).

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Links

Albemarle-Pamlico National Estuary Program	http://www.apnep.org/
Charlotte-Mecklenburg Stormwater	http://www.charmeck.org/Departments/StormWater/Storm+Drain/Home.htm
City of Durham	http://www.ci.durham.nc.us/departments/works/stormwater_public.cfm
City of Wilmington	http://www.wilmingtonnc.gov/public_services/stormwater.aspx

Clean Water Education Partnership	http://www.nccwep.org/
Environmental Resource Program - Commercial Sector	http://www.ie.unc.edu/erp/commercial_stormwater.cfm
NC Big Sweep	http://www.ncbigsweep.org/
NC Department of Environmental Education	http://www.ee.enr.state.nc.us/
NC State University Watershed Education for Communities and Officials	http://www.ces.ncsu.edu/depts/agecon/WECO/
NC Stormwater & Runoff Pollution Program	http://www.ncstormwater.org/
NC StreamWatch	http://www.ncwater.org/Education_and_Technical_Assistance/Stream_Watch/
Piedmont Triad Water Quality Partnership	http://www.piedmontwaterquality.org/
Stormwater Pollution Prevention for Restaurants-Spanish (Chapel Hill)	http://www.ci.chapel-hill.nc.us/index.aspx?page=1645
Stormwater SMART	http:// www.stormwatersmart.org
Town of Chapel Hill	http://www.ci.chapel-hill.nc.us/index.aspx?page=392

Publications

Albemarle-Pamlico National Estuary Program Workbook for Kids	http://www.piedmontnutrientsourcebook.org/Assetts/outreach/stormwaterfinal.pdf
A Review of Research Relevant to Evaluating Social Marketing Mass Media Campaigns	http://www.piedmontnutrientsourcebook.org/Assetts/outreach/evaluating-social-marketing-mass-media-campaigns.pdf
CWEP Annual Report 2009-2010	http://www.piedmontnutrientsourcebook.org/Assetts/outreach/CWEP_FY10_Annual_Report.pdf
CWEP Brochure	http://www.piedmontnutrientsourcebook.org/Assetts/outreach/CWEPbrochureforweb.pdf
Good Cleaning Practices: Food and Restaurant Industry (Durham)	http://www.piedmontnutrientsourcebook.org/Assetts/outreach/restaurant BMPs - letter size.pdf
Guidance for Local Governments Using Radio and Television Advertising	http://www.piedmontnutrientsourcebook.org/Assetts/outreach/Guidance-for-Local-Governments-Using-Radio-and-TV-Advertising.pdf
Guide to Water Pollution Prevention for Food Service Establishments	http://www.piedmontnutrientsourcebook.org/Assetts/outreach/water pollution food service.pdf
Public Outreach about Stormwater (WECO)	http://www.piedmontnutrientsourcebook.org/Assetts/outreach/PublicInvolvment.pdf
Motor Vehicle Washing (Durham)	http://www.piedmontnutrientsourcebook.org/Assetts/outreach/Proper Containment Collection and Disposal of Wastewater (NOV 09).pdf

DWQ: Improving Water Quality in Your Own Backyard	http://portal.ncdenr.org/c/document_library/get_file?uuid=b1fb84b4-b183-41a2-a211-113e287be2f9&groupId=38364
Watershed Collaborating (WECO)	http://www.piedmontnutrientsourcebook.org/Assetts/outreach/WatershedCollaborating.pdf
WECO Brochure	http://www.piedmontnutrientsourcebook.org/Assetts/outreach/WECO_brochure.pdf

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Due to the constantly changing nature of the internet, many web addresses may not be accurate after the publication of this manual. If you are unable to obtain any reference material, please contact TJCOG or PTRC staff and we will be happy to assist you.

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A very special thanks to the many participants who contributed their time and knowledge to this research project. We interviewed professionals across many departments at a regional, State and National scale. Almost all Jordan Lake watershed communities spent many hours completing the extensive survey that was the basis of this project. We would also like to thank intern Jae Kim, for his help conducting interviews and meticulously entering survey data, the following DWQ staff for their valuable input: Bridget Munger, Jason Robinson, John Huisman, Rich Gannon & Karen Higgins, and Tom Gerow with NCDA&CS – North Carolina Forest Service.

APPENDIX A. LOCAL GOVERNMENT SURVEY

SUMMARY

The Jordan Lake Rules were signed into law in 2009; this project began in 2010, in order to empower local governments to most cost-effectively comply with those Rules. The contents, however, are aimed at all communities throughout the Appalachian Piedmont struggling to manage nutrient and stormwater under challenging environmental and historical conditions. Prior to compiling this *Sourcebook* and website, the Piedmont Triad Council of Governments (PTCOG) and the Triangle J Council of Governments (TJCOG) polled Jordan Lake communities to assess their preexisting knowledge of nutrient reduction and their capacity to implement regulatory programs and achieve nutrient reduction targets. The purpose of this assessment was to help focus this *Sourcebook* to fill information gaps and provide targeted information and resources that would assist local government in meeting nutrient reduction goals.

In Summer 2010, PTCOG and TJCOG sent out an extensive survey addressing 13 relevant policy- and technology-based nutrient reduction strategies to each Jordan Lake watershed local government. This survey was informed by an Upper Neuse River Basin Association (UNRBA) survey that gauged the abilities of the communities in the Upper Neuse River Basin to comply with the Neuse River Nutrient Management Strategy. Additional questions were added to address specific nutrient reduction concerns in the Jordan Lake watershed, and to assist the University of North Carolina's School of Government in drafting a Jordan Lake new development model ordinance.

There was a 79% response rate to the survey (27 of 34 communities), with varying levels of detail provided for individual questions. Most of the respondents addressed all the questions, providing valuable information that guided the compilation of this *Sourcebook*. In the responses, some trends were apparent:

- Communities subject to NPDES stormwater regulations were more familiar with watershed management principles and seemed more prepared to address nutrient reductions;

- There was an noticeable difference in agricultural vs. urban areas in regards to their approaches to watershed management which seems to indicate a need for better communication;

- Many communities appeared to support voluntary (but not mandatory) emerging technologies and development standards (performance-based BMP standards, low impact development, greywater technologies, etc.);

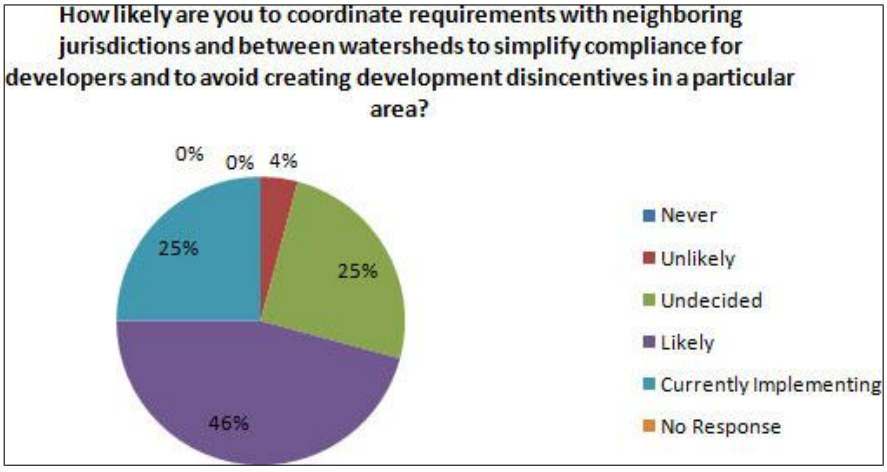
- There appeared to be several areas where most communities were not well equipped or had previous knowledge (forestry practices, educating the private sector); and

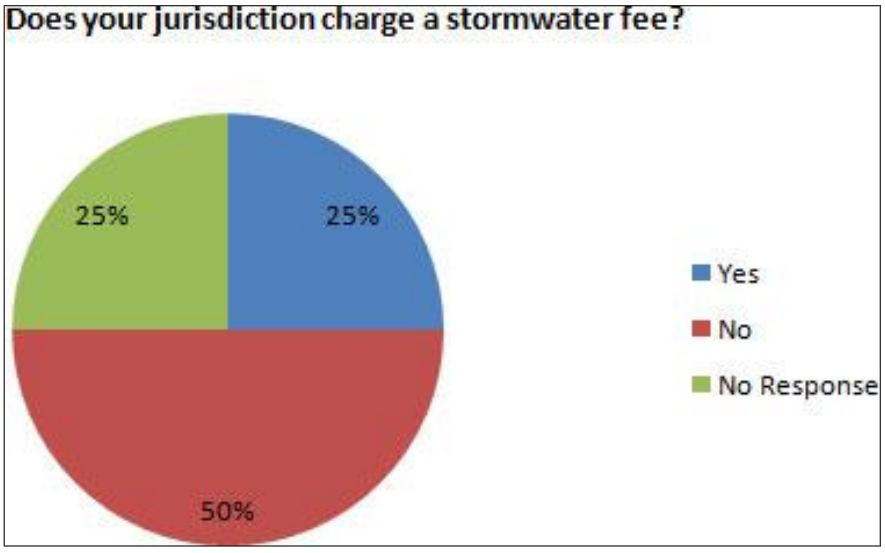
- It appeared that most communities did not support the use of approaches (especially if made mandatory) that went above-and-beyond compliance (more comprehensive monitoring, incentivizing LID, etc.).

The following pages summarize the responses to all 13 sections of the 75-page nutrient reduction survey sent to Jordan Lake watershed communities. These responses helped to inform the development of this *Sourcebook* and website, and aim to give watershed communities a tool to address their nutrient reduction requirements in the most cost-effective and successful ways available in the Piedmont region of the United States. If you would like more information about the survey, or would like to request a copy of survey questions and responses, please visit the website at http://www.piedmontnutrientsourcebook.org/survey.html.

NEW DEVELOPMENT

Many of the local governments surveyed indicated that they are interested in developing new tools to minimize the impacts of development on water quality without putting undue burden on the development community. The new DWQ Nutrient Loading Accounting Tool developed through partnership between DWQ and NC State University (NCSU) addresses this need, giving planners and developers a simple spreadsheet tool to estimate pollution runoff from a development. Users of the tool can enter BMP information and determine what BMPs, or combination of BMPs, can mitigate nutrient loads (NCSU 2011).

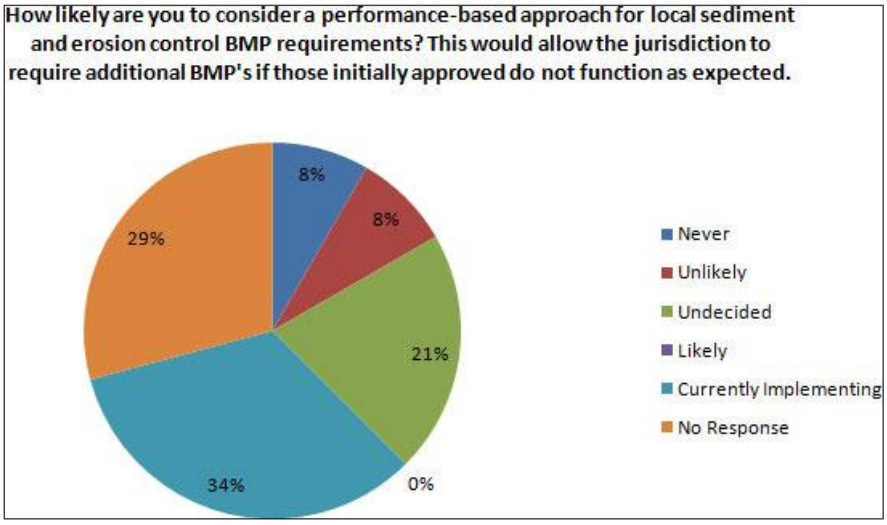




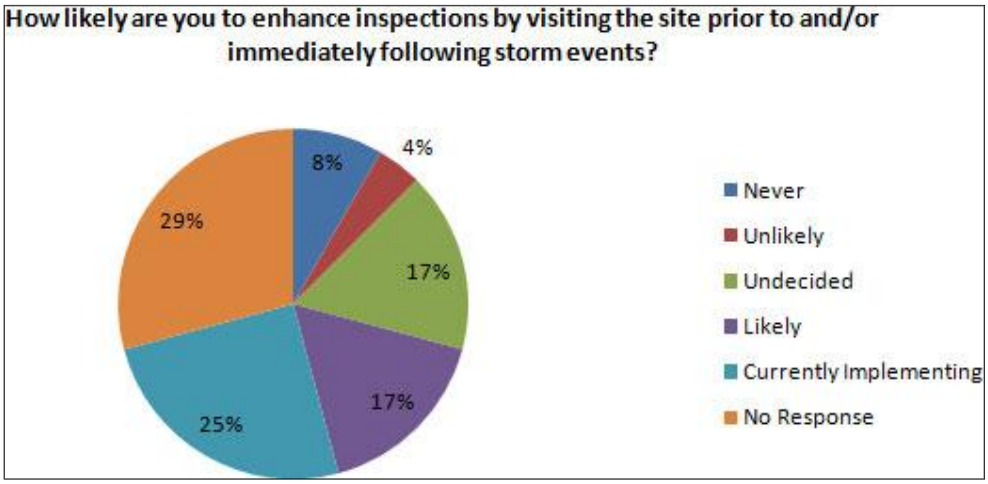
Many communities do not provide financial incentives to projects that could potentially address the pollution footprint of developments. A discussion about such practices and policies, and their benefits to local economies, could be held in the watershed to educate and encourage local government about this practice. Based on the survey results, 25% of the communities surveyed do not charge stormwater fees, which may limit their financial ability to address the nutrient impacts from development.

CONSTRUCTION SITE INSPECTIONS & ENFORCEMENT

All communities that are federally-required to address soil and erosion control through stormwater practices appear to be interested in ways to improve their programs; however there are some differences of opinion among local governments as to mandating performance-based BMP standards).

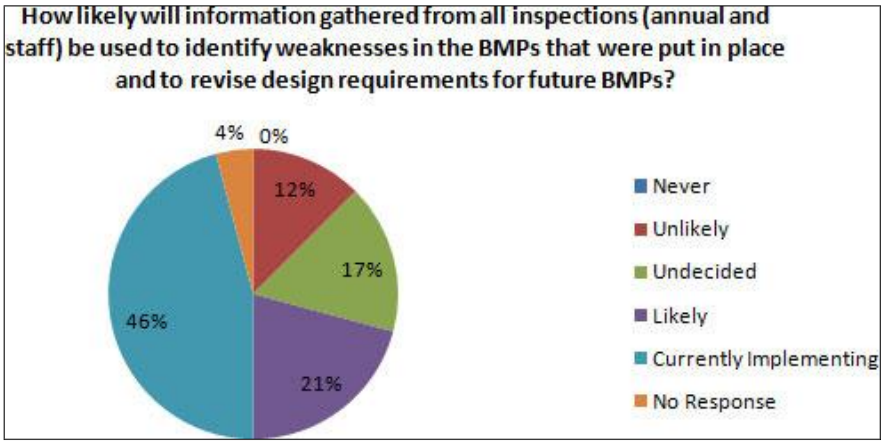


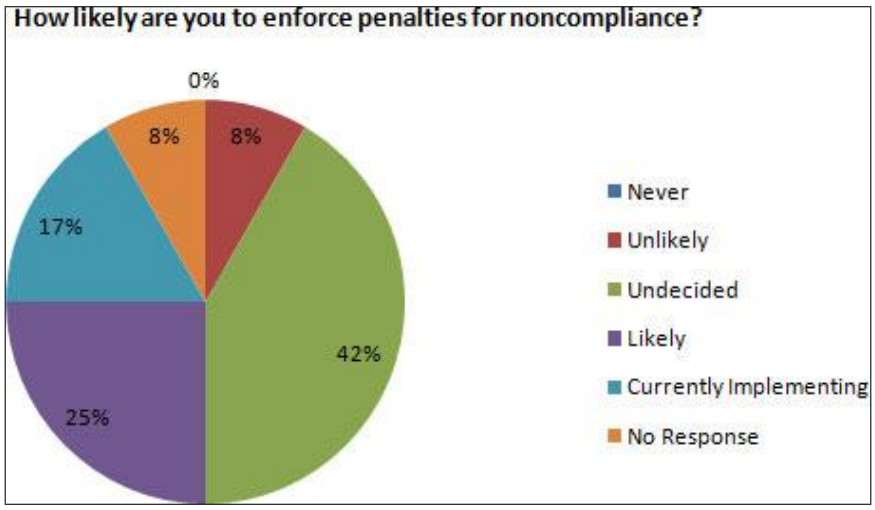
Sixteen percent (16%) of the communities surveyed indicated that were not likely (never or unlikely) to implement a performance-based approach for local sediment and erosion control practices. Because sediment runoff can transport nitrogen and phosphorous with it, it is important to control. The communities subject to NPDES regulations and that must reduce their nutrient loadings in the Falls Lake Rules, and Stage 2 of the Jordan Lake Rules require BMPs to address sediment and nutrients in runoff, and through partnerships with their neighboring communities, local governments can more cost-effectively address this source of pollution.



BEST MANAGEMENT PRACTICES

Over a third of the Jordan Lake watershed communities did not have stormwater maps when the Rules were passed. This same third appears unprepared to inspect the stormwater BMPs, as required by both the Jordan Lake Rules and Falls Lake Rules. Many of their neighbors are well-equipped to deal with these issues due to their requirements under the NPDES programs. While it appears that all communities wish to have their own inspections programs, resources could be saved through a regional program. The watershed will be well-served if this knowledge and resources are shared – both practically and financially – amongst communities to effectively reduce nutrient loading from developed areas.

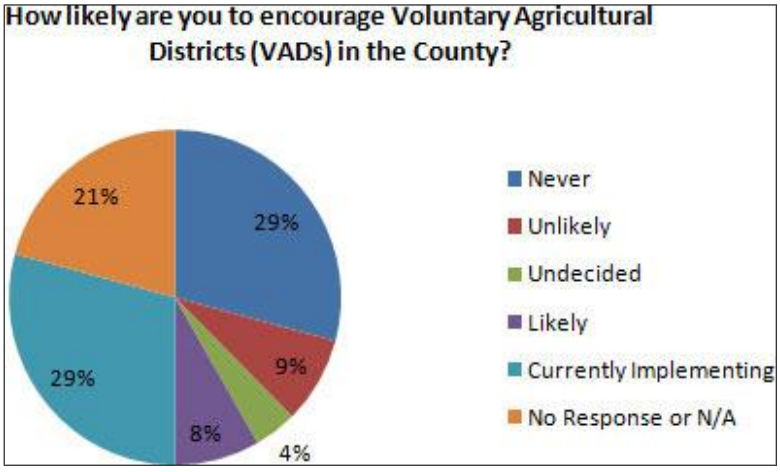




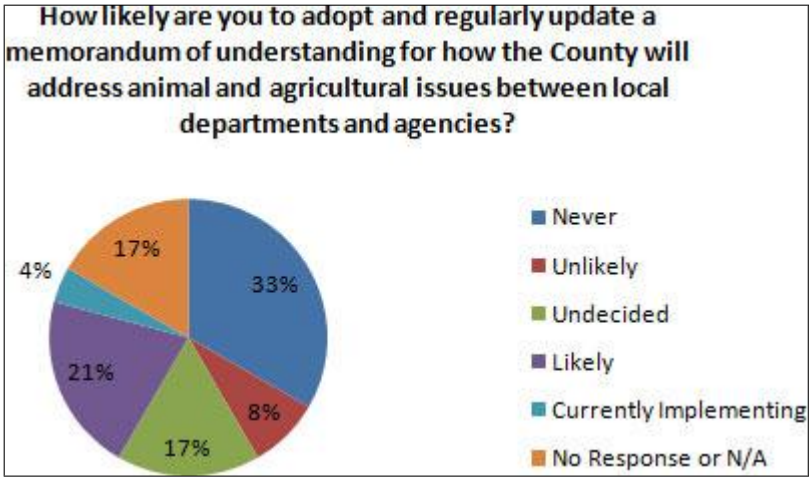
Many watershed communities show little interest in enforcing ordinances determining BMP performance and maintenance, despite the requirements of federal NPDES regulations and state nutrient management strategies (USEPA 2001). Without a functioning BMP inspections and enforcement program, NCDENR can have no confidence that BMPs are working properly, casting doubt upon the performance of all BMPs in that community

AGRICULTURE

State and federal agricultural cost share programs are popular with Jordan Lake watershed communities. However, there is a persistent disconnect between some cities and towns and the rural communities that surround them that cripples the application of these programs to the places they would do the most good. Almost half of the respondents – all of them urban – stated that they are "Unlikely" or "Undecided" about whether to publicize or promote programs like the voluntary agricultural districts and cost-share programs. This is likely due to the inability of agricultural and urban stakeholders to receive credit for mutual nutrient reductions, even within a local watershed.

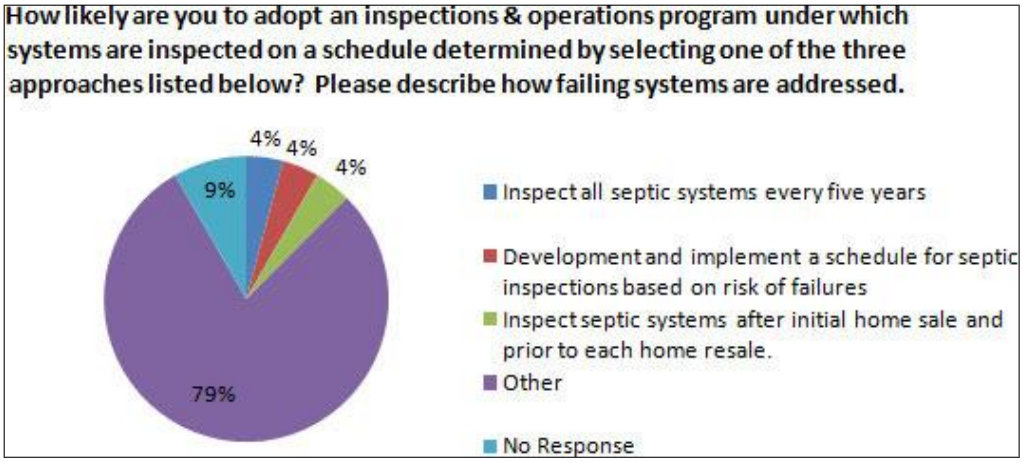


This situation persists despite the inter-jurisdictional partnerships can benefit many of these programs. Agricultural cost-share monies are dedicated to watershed stability, sometimes in urban environments (e.g. Community Conservation Assistance Program (NC Department of Agriculture & Consumer Services 2011). It also shows a division between the urban and rural communities that persists throughout the survey. This divide needs to be addressed so that the cost-effective benefits of inter-jurisdictional partnerships at the watershed and catchment scales can be realized.

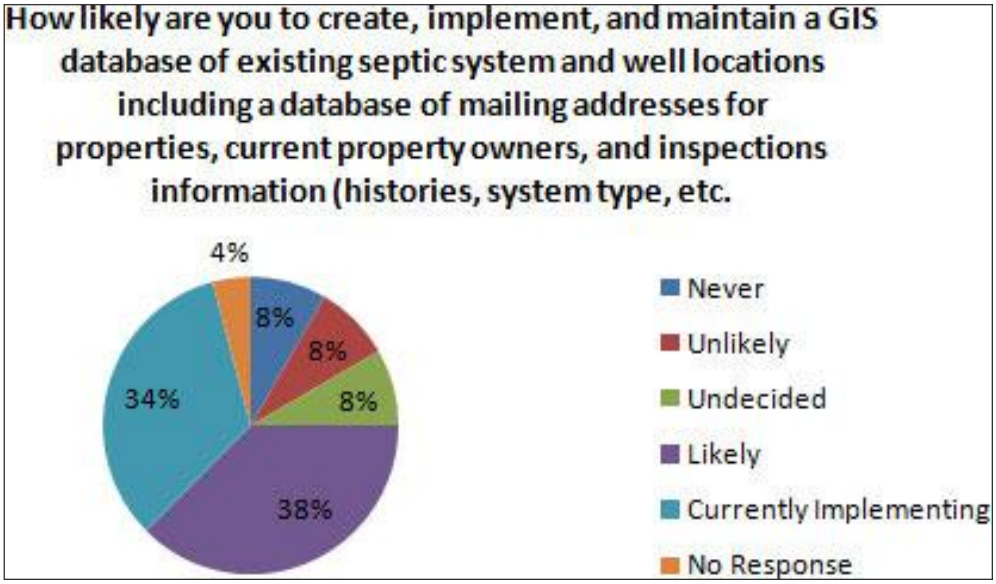


SEPTIC SYSTEM MAINTENANCE & INSPECTIONS

A septic system inspections and maintenance program is required in Stage I of the Jordan Lake Existing Development Rule as a component of a community's adaptive management plan (DWQ 2011a). Most septic systems have life spans of about 30 years. They are contributing approximately 15% of nutrients to Falls Lake (DWQ 2011b).

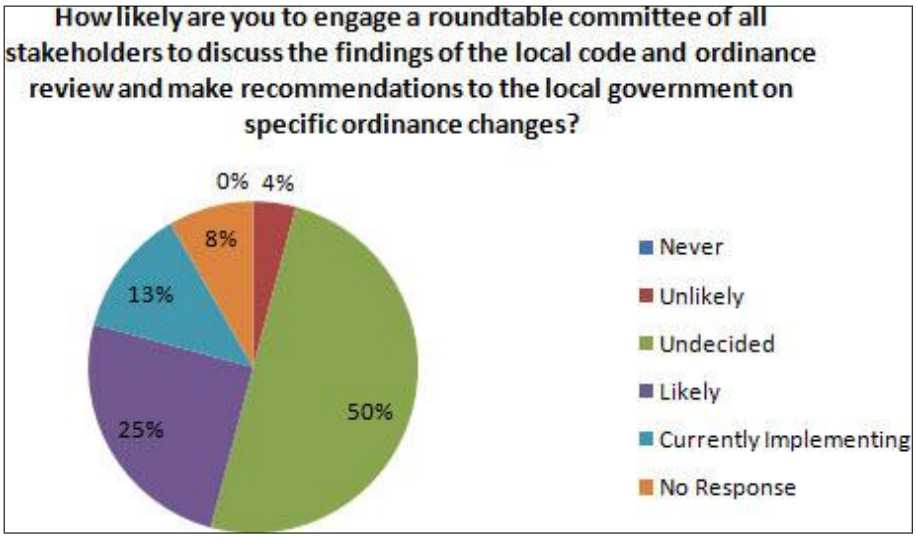


Many answered "Other," indicating that questions asked may have been too prescriptive. If these responses are indicators of customized local programs, then this knowledge could be shared with others. However, it could also indicate a lack of inspections. Other responses indicate a lack of commitment for about one-fourth of communities, who responded that they do not intend to maintain records or require systems inspector certification.



LOW IMPACT DEVELOPMENT

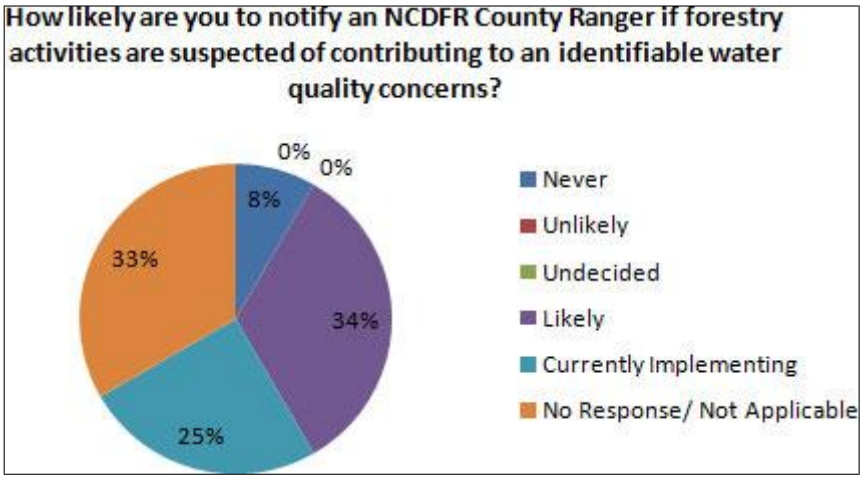
Unlike New Development requirements, LID incentives appear to be popular amongst most communities, and seen as a way to reduce the stormwater footprint of redevelopment and new development projects. Few, however, are interested in incentivizing or requiring LID, even for environmentally-sensitive areas in their communities. Many of these communities appear to be interested, but cautious, giving "Undecided" responses to questions about official promotion of LID in the technical review process.



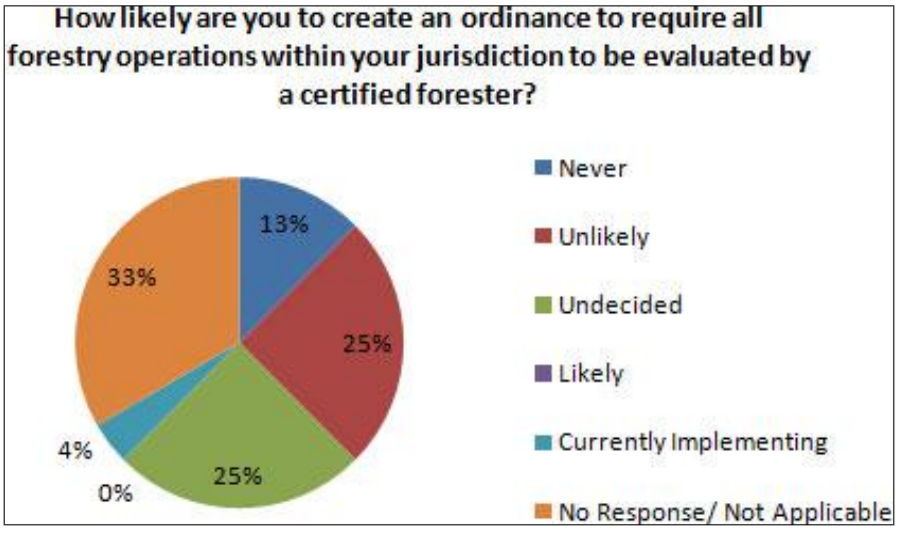
A watershed-wide discussion of LID and its benefits and costs to the private and public sectors would be a worthwhile way to show the great benefits that result from a small, upfront cost. This potential partnership between the public and private sectors could hold great promise for water quality conditions.

FORESTRY PRACTICES

Local governments currently have limited authority to regulate the nutrient and sediment runoff from forestry operations. Nor do these properties fall under the responsibilities of the agricultural sector, according to both this specific legislation and much broader state statutes. However, there are regulatory tools that local governments clearly are not taking full advantage of, to the detriment of the entire watershed arm they lie in. Only half of the communities stated that they would contact the Department of Forest Resources if they observed pollution from a forestry operation.

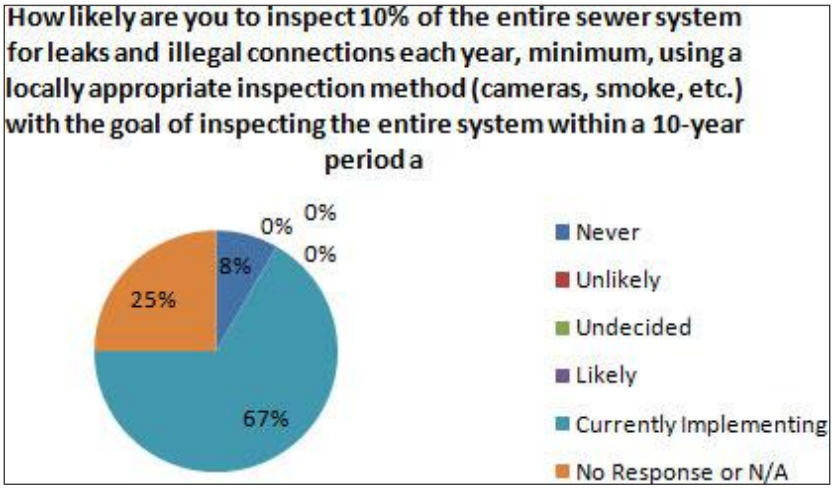


The steps to redress or prevent forestry impacts are simple and inexpensive, and not using them allows tons of sediment and nutrients to flow into the watershed. The lack of communication and partnership between the NC DFR and local communities in this matter makes forestry operations a potentially significant and persistent source of pollution to Jordan Lake. While state statute currently limits the authority of local governments to address forestry operations within their jurisdictions, an ongoing dialogue with NC DFR staff could lead to significant nutrient reductions from ongoing operations.

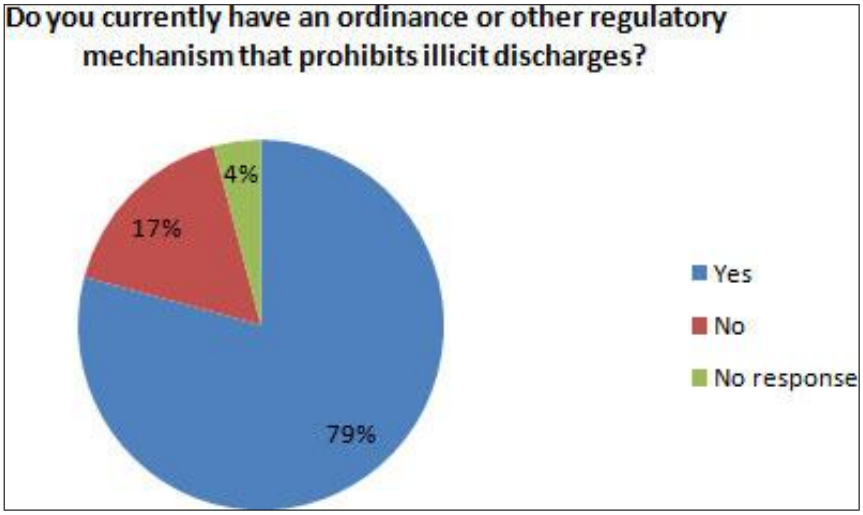


ILLICIT DISCHARGE DETECTION & ELIMINATION

Most of the Jordan Lake watershed communities appear to have a good handle on illicit discharges, and mitigating their nutrient loading to their local waters. Given the high cost to benefit ratio of such a program, this is encouraging for watershed conditions.

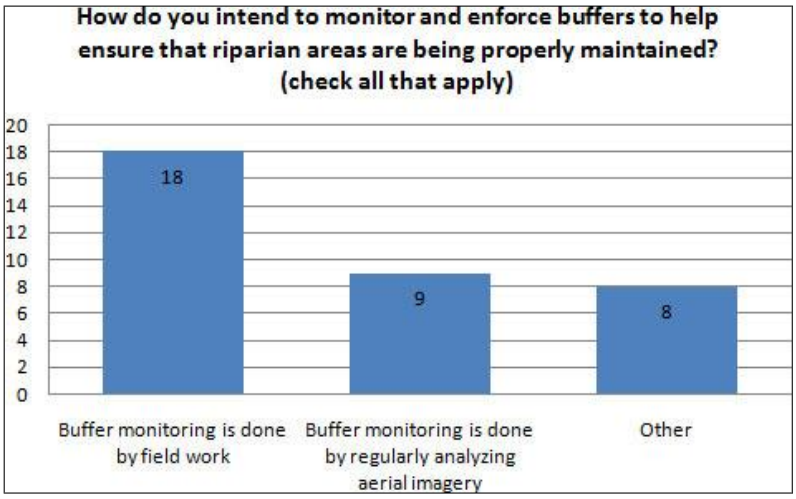


There are a few communities that are not doing this work, suggesting that inter-jurisdictional partnerships might be a remedy for these exceptions. It is likely that these communities are the non-NPDES stormwater communities. An illicit discharge program will require them to pass ordinances that permit public employees on private lands for inspections and enforcement purposes, which could be a local political concern.

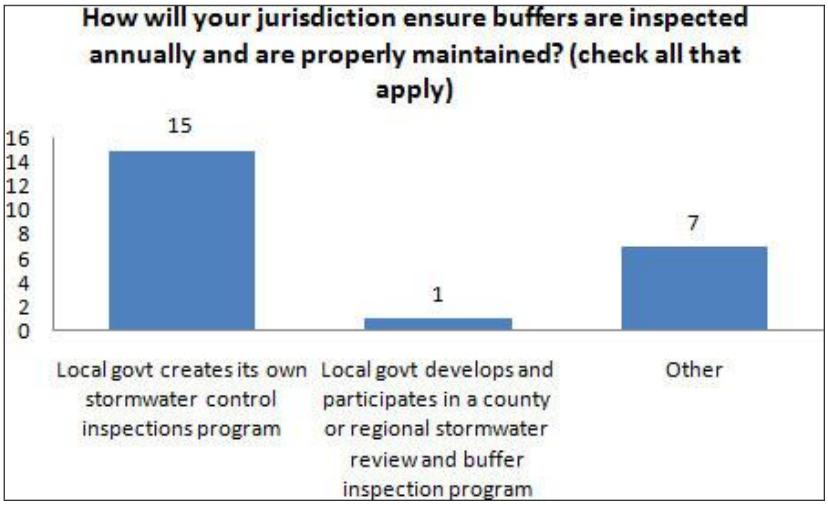


RIPARIAN BUFFERS

All North Carolina nutrient management strategies require communities to protect the fifty-foot buffers, but about a quarter of them do not have a clear plan on how to inspect these stream buffers. The Riparian Buffer ordinances for every water body with a nutrient management strategy were adopted and at the time of this writing (Summer 2011), but the actual capacity to enforce this ordinance is an ongoing challenge (NCDENR 2011).

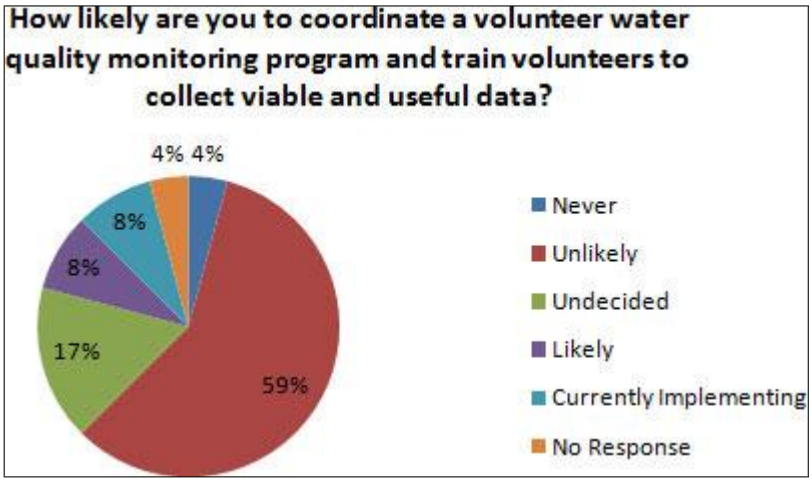


This may be a program that could be supported through inter-jurisdictional partnerships and/or resource sharing. Many communities have high-resolution aerial surveys done annually, which can clearly show impacted stream buffers. Combining resources to provide such data is a cost-effective way to manage this program, as could an enforcement program (see BMP Maintenance Section). Both will require pooling public funds, which can be politically tricky and is not very interesting to many of these communities.



WATER QUALITY MONITORING

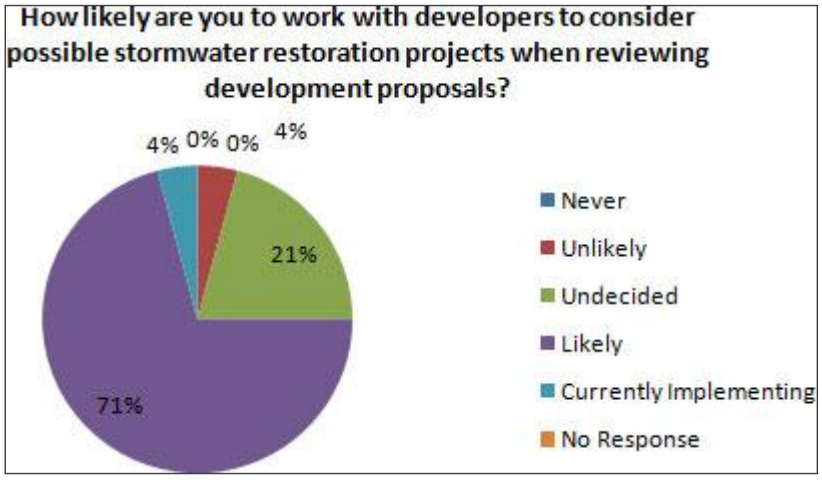
Jordan Lake watershed communities are reluctant to monitor their water quality at greater levels than they are currently. Most show no interest in working with volunteer groups to collect data that many resource-strapped departments do not have the time or the staff to gather.

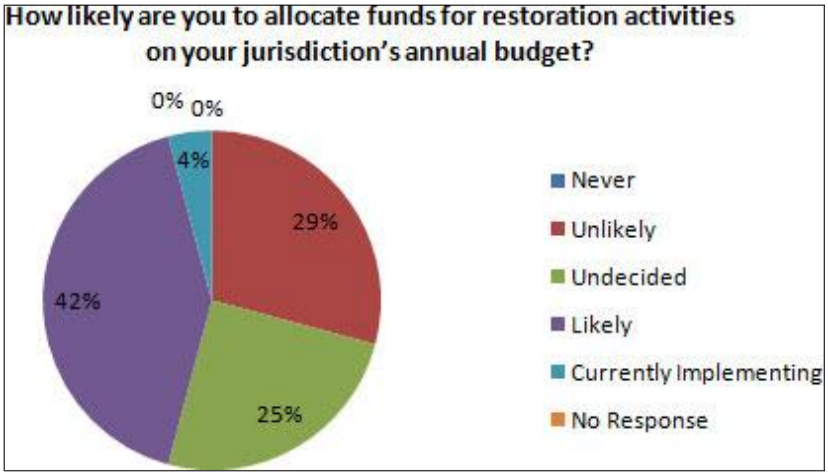


Given the need to track water quality conditions to better manage nutrient runoff, this position is concerning. Without more comprehensive water quality data, there is a danger that resources may be misdirected and not address the easiest and more potent sources of pollution in a community. The hesitancy may be due to a concern that NCDENR will not use this data to determine if water quality is degrading or improving. The opportunities to use a much richer data set to inform upon watershed conditions is currently being squandered as a result.

WATERSHED RESTORATION PLANNING

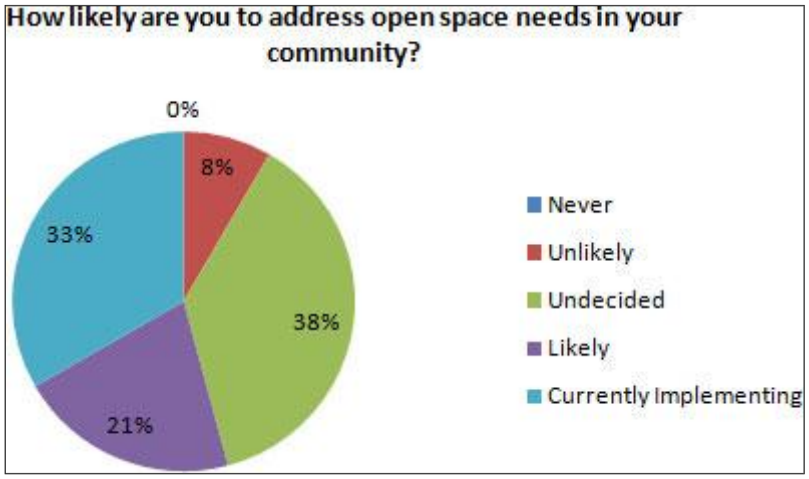
The responses to the watershed restoration planning section show a uniform awareness by watershed communities that they need to address the sources of pollution and watershed concerns present in their jurisdictions. This awareness is undermined by an unwillingness to invest resources to improve conditions. While almost all communities stated that they discuss stormwater needs with developers, and are always on the lookout for new ways to improve watershed conditions, there is a lack of committing to these needs. There is an interest in using grant funds or working with the private sector to plan and implement watershed restoration efforts. There is also an interest in improving watershed conditions to garner nutrient credits that may later be traded on a market. However, most communities still treat watershed management and stormwater maintenance as an amenity rather than community service that they have a duty to deliver.





CONSERVATION PRACTICES

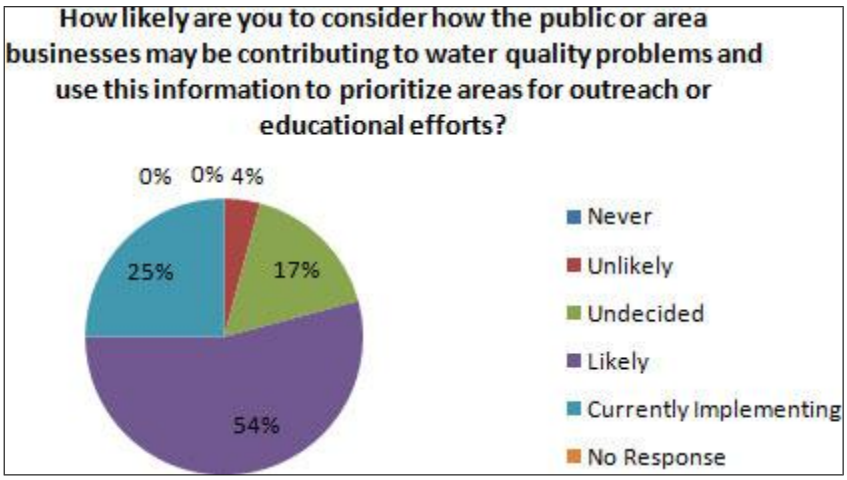
There is a divide amongst Jordan Lake watershed communities about applying conservation practices to their local watersheds and banking open space, healthy streams, and inexpensive BMPs (i.e. trees) for a possible nutrient credit trading market. NC Session Law 2011-343 explicitly prohibits local governments from banking riparian buffers, stream restoration and wetland remediation projects, though they are still permitted to trade these nutrient credits within their jurisdiction (i.e. the wastewater discharge plant can give or sell nutrient credits to the municipal stormwater department). Half of the communities would be willing to invest in and protect these areas and services; the other half appears uninterested. At this point, a private third party would have to be involved to broker any trades for riparian buffer or nutrient credits between entities.



The Center for Watershed Protection has shown that preventing degradation of natural systems is the most cost-effective way to prevent pollution. Communities may be able to reduce or minimize their nutrient loading by improving lightly-used areas and preventing others from being paved over, while at the same time fulfilling community goals for public health, recreation, and economic development (Schueler & Holland 2000). The City of Raleigh is making such investments in the Falls Lake watershed to protect and restore ecosystem services in upstream jurisdictions, which helps protect its drinking water source.

PUBLIC EDUCATION & OUTREACH

Most of the Jordan Lake watershed communities are taking advantage of the public involvement and community education programs available to them. The few that are not should consult with their neighbors to see how they might cost-effectively address these needs. There is less of an interest in more actively promoting these programs to the private sector or to the general public through brochures or programs like Adopt-a-Stream, but still a majority of communities are interested. Again, conversations amongst these neighbors could result in cost-effective and easy improvements in nutrient reduction programs.



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